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THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. OCTOBER 4, 1900. CHICAGO, ILL. NUMBER 40

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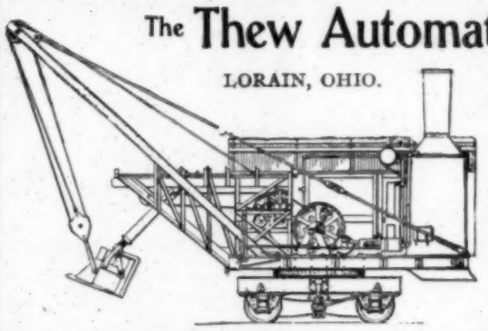

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THE IRON TRADE REVIEW

VOLUME XXXIII. CLEVELAND, O. OCTOBER 4, 1900 CHICAGO, ILL. NUMBER 40

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

The rail situation is at the moment the leading feature in the iron trade. Contrary to prediction the railroads are disposed to take hold at the $26 price, and some of them are not waiting until after the election to cover their needs. Judging from inquiry already in hand and the preliminary estimates given out from official sources, the buying for next year will be large. Chicago has sold more than 30,000 tons the past week. Pittsburg has a large business in hand. The Pennsylvania order, soon to be placed, is expected to aggregate 150,000 tons. B. & O. officials have announced that they will buy 40,000 tons. Several Eastern lines have been heard from in a tentative way, with inquires running over 50,000 tons. In the Cleveland district 20,000 tons for electric lines are being figured upon, and nearly as much more for steam lines. Coming some weeks earlier than usual the rail demand is expected to assume proportions that will make no pressure by the rail mills upon the billet market, and thus will exert a steadying influence on finished lines. Further proof of the ability and the readiness of the railroads to buy comes in the B. & O. order for 6,000 steel cars and 3,100 wooden cars placed in the past week. The steel car order will require 100,000 tons of steel, of which 60,000 tons in plates, or as President Cowen puts it, the equivalent of the steel plates required to build 10 of the largest steel freighters afloat. The effect of this order will be to strengthen the plate market, which has been drooping again in the past three weeks. In general the market of the week has shown increasing demand. Whether because confidence is growing in the result of the election, or simply because of the simultaneous exhaustion of stocks under the large consumption recently in evidence, there is undoubtedly larger buying. As heretofore the end of the year is about the limit of ordinary contracts, though there are exceptions; but the whole market is working into a position from which an advance would not be difficult under the free buying looked for, with the election out of the way. Bessemer pig iron is lower, a sale having been made at $13.25 Pittsburg and the pressure of stocks is still being felt. Steel billets are also weaker, but the business is so largely on sliding scale contracts that sales are not significant. The foundry iron trade is more active, buyers reporting that the demand for castings is improved. Prices are a shade weaker, though some important sellers still maintain the position they have held for some weeks. There is thus some irregularity in prices. The settlement of the tin house workers' scale disposes of the last of the wage questions that have hung over the situation for the past three months, but there is yet pending the matter of reconizing the tin workers' union at all plants of the American Tin Plate Co, and this may prove troublesome. The outlook is for full employment of finishing mills in the Central West for the next two or three months at least. The closing of the Joliet works is a conspicuous exception to the general rule. Here the fact that the output of the rod mill goes to a single customer made the suspension of operations necessary.

PITTSBURG.

[Special Telegram.]

Oct. 3.—On a lot of 5,000 tons of Bessemer $13.25, Pittsburg, was done today. The movement in Bessemer iron is increasing perceptibly, and the valley furnacemen are eagerly offering their accumulated stocks to prospective buyers.

The scale of the tin house workers has not yet been sigeed by the American Tin Plate Co. The stumbling block is the demand of the workers to have the company sign the scale for all its plants. A slight advance has been granted the men.

OFFICE OF *The Iron Trade Review*,
429 PARK BUILDING, Oct. 3.

During the past week the Pressed Steel Car Co., of this city, received from the Baltimore & Ohio railroad one of the largest orders yet placed for steel freight cars. It calls for 6,000 steel cars, and will require 60,000 tons of steel plates which will be furnished by the Carnegie Steel Co., and 40,000 tons of other steel material that enters into the construction of the car. While the officials of the Baltimore & Ohio were in Pittsburg they stated that they would purchase no less than 40,000 tons of rails this year, and according to prevailing reports the Pennsylvania Railroad Co. will place orders for close upon 150,000 tons of steel rails. This order will undoubtedly go largely to the mills along the main line of the Pennsylvania road, the Carnegie Steel Co. Cambria Steel Co., and the Pennsylvania Steel Co. being the favored concerns. The Buffalo, Rochester & Pittsburg Railroad Co. placed an order last week with the Carnegie Steel Co. for 2,500 tons of rails, and later may add several thousand tons. Among recent business is an export order for 6,000 tons placed with the Pennsylvania Steel Co. It has been persistently rumored that the agreed price of $26 on rails has been broken but this has been denied by officials of the steel companies. According to present indications a considerable tonnage of rails will be placed before election, contrary to the expectations of the steel manufacturers. While buying of finished material was not abnormal during the past week it was much better than the most sanguine expected, with the national election only five weeks off. Tank plates continue to show the only weakness, and it is believed that they will shortly be firmer owing to the large order the leading interest will receive in view of the B. & O. steel car contract. Bessemer iron showed more activity during the past week than for several months, and all told about 12,000 tons was sold. Small lots were placed at $13 75 per ton, while large lots were contracted for at $13.50. In comparison with other products, Bessemer iron is very low. While $13.50 seems to be the bottom price reached at the time of this writing, it is not certain that this will not be shaded, as there are large amounts of Bessemer iron in stock at the valley furnaces that merchant furnacemen are anxious to unload. Several thousand tons of low phosphorus Bessemer, with phosphorus at .035, were sold at $22 in lots of 1,000 tons. Of the many scales with which the iron and steel manufacturers had to contend, the last — the tin house employes' scale — is apparently settled. So far as the wage question is concerned, the American Tin Plate Co. has granted the men a slight advance, and the bone of contention at this writing is the request of the workers to have the manufacturers sign the scale for all the plants in which the tin house workers are unorganized. It is hardly possible that this will be done.

PIG IRON.—There was considerable buying of Bessemer iron the past week, the low prices inducing buyers to come into the market. Fully 10,000 tons were sold at prices ranging from $13.50 to $13.75, and it is believed that a slightly lower figure may be quoted before the end of the week owing

to the large offerings of the furnacemen, who now seem very anxious to get rid of their large stock accumulations. Low phosphorus Bessemer brought $22 per ton in two lots of 1,000 tons each. The buying of foundry iron is fair. No. 2 ranges from $14.25 to $14.75, while mill iron is selling at $13 to $13.25. We revise our quotations as follows:

Bessemer, Pittsburg	$13.50 to 13.75
No. 1 Foundry	14.25 to 14.75
No. 2 Foundry	14.00 to 14.75
No. 3 Foundry	13.50 to 14.00
Gray Forge, Pittsburg	13.00 to 13.25

STEEL.—The inactivity in steel billets continues. Sales of several small lots are reported at $17.50 but it is believed large lots can be had at $17, and it is believed very desirable orders could be placed at $16.75. There is very little doing in sheet and tin bars. Long-length, heavy sheet bars are quoted at $21, while light tin bars are quoted at $23 per ton.

FERRO-MANGANESE.—The largest producer has announced a reduction of $10 per ton in manganese. Domestic 80 per cent is quoted $75 per ton.

RAILS AND TRACK MATERIAL. — The steel manufacturers have been pleasantly surprised during the past few days by the large quotas of rails under discussion by the railroads for consumption next year. Officials of the Baltimore & Ohio railroad while in this city last week announced that they would place orders for no less than 40,000 tons of rails for the ensuing year, and intimated that the order would be placed before election. In addition, the officials of the Pennsylvania road are authority for the statement that they would purchase no less than 150,000 tons, and that the order would be placed in the near future. Other roads are getting in line, and it is the opinion among the steel rail manufacturers that a very large tonnage will be placed before election. The Carnegie Steel Co. has already booked an order for 2,500 tons for the Buffalo, Rochester & Pittsburg railroad, and the Pennsylvania Steel Co. has booked a 6,000-ton order for foreign shipment. The large buying of track material has not yet commenced, but it is altogether probable that with the early buying of rails there will be a similar movement in track material. We make the following quotations: Rails, standard sections, 50 pounds and over, in lots of 200 tons and over, $26; car lots and less than 200 tons, $28; less than car lots, $30; 16 to 25-pound rails, $28; 25 to 50 pounds, $25. Track material: Spikes, 1.75c; track bolts, square heads, 2.05c; hexagon heads, 2.15c.

SPELTER.—The market continues dull. Prime Western grades are held at 4.05c to 4.10c, Pittsburg.

MUCK BARS.—There is little doing, and standard product is held at $26, which is considered too low for a profit by the majority of the manufacturers.

SKELP.—There is a fair demand for iron skelp, which is held at prices ranging from 1.50c to 1.60c. There is a good demand for grooved skelp, and better prices have been paid for it than for iron skelp, which is exceptional. Steel skelp is not in very great demand, and is selling at 1.30c to 1.35c.

BARS —A fair demand for bars continues, and prices for large lots range from 1.15c to 1.20c. The officials of the American Steel Hoop Co. report an exceptional demand for cotton ties and bands, and their mills are rushed to get out orders for immediate delivery. Common iron bars are quoted at 1.30c to 1.35c, Pittsburg, and refined iron bars from 1.75c to 2c.

SHEETS.—Black sheets continue in good demand, and prices are somewhat firmer. No. 28 gauge, one pass through cold rolls, are quoted at 2.95c to 3c, and No. 27 gauge at 2.85c to 2.90c, with some selling by independent mills at slightly lower figures. There is a fair demand for heavier sheets, on which we quote as follows: No. 10, 1.40c to 1.45c; Nos. 11 and 12, 1.50c to 1.55c; No. 14, 1.60c to 1.70c; No. 16, 1.75c to 1.85c, and No. 18 at 2.10c to 2.15c; No. 20 at 2.35 to 2.45c. Galvanized sheets are in excellent demand and are quoted 75 off with the customary 15-cent freight allowance.

STRUCTURAL MATERIAL. — The Carnegie Steel Co. was awarded the contract to furnish the structural material for the new Empire Theater to be built here. The order calls for about 800 tons. Demand is fair, with prices unchanged as follows: Beams and channels, 3 to 15 inches, 1.50c; 18 to 24 inches, 1.60c; tees, 1.55c; zees, 1.50c; angles, from 3 to 6 inches, 1.40c. Universal mill plates, 1.15c to 1.20c, according to delivery and size of order.

PIPES AND TUBES.—Prices on pipes, tubes and casings aer firm, with an excellent demand. Discounts to consumers in carload lots, Pittsburg, remain unchanged, and are as follows:

MERCHANT PIPE.

	Black, per cent.	Galvd. per cent.
⅛ to ¼ inch and 11 to 12 inch	61	48
⅜ to 10 inch	68½	56

BOILER TUBES.

	22 Feet and under. Per cent.		Over 22 Feet. Per cent.	
	Iron.	Steel.	Iron.	Steel.
1 to 1¼ and 2¼ inches	49½	55	44½	50
1¼ to 2¼ inches	45	51	39½	46
2¼ to 13 inches	57	62	52½	58

CASING.

	S. and S. per cent.
2 to 3 inches	55
3 to 4 inches	60
4¼ to 12¼ inches	65

O. D. PIPE.

	Per cent.
14 to 22 inches	42
24 inches, o. d. and larger	37

THREADS AND COUPLINGS.

	Per cent.
14 to 16 inches, o. d.	35

PLATES.—The order placed by the Baltimore & Ohio Railroad Co. with the Pressed Steel Car Co. for 6,000 steel freight cars calls for about 60,000 tons of plates. The Carnegie Steel Co. will supply the steel, and without doubt this large contract will have a tendency to strengthen the plate market, which has been much weaker than that of any other finished line. Tank plates in small lots are quoted at 1.10c, while large lots can be placed for 1.05c. The railroads are buying considerable steel for locomotive construction, and several desirable orders were placed during the week. Shell steel is held at 1.15c to 1.25c, while flange is quoted at 1.25c to 1.30c. Firebox and special grades range in price from 2c to 3c.

MERCHANT STEEL.—The largest producer of crucible steel reports a very good demand. Other kinds of merchant steel are also in fair demand, with prices unchanged. We quote toe-calk at 1.25c to 1.30c; tire steel from 1.50c to 1.60c; tool steel at 7c and upwards; spring steel at 2.25c base to 2.50c.

WIRE AND WIRE NAILS.—At a meeting of the cut nail manufacturers, held last week, it was decided not to reduce prices. Terms of payment also remain as heretofore. The association was not dissolved, although it was reported that this was done. The demand for wire and wire nails is reported good by the jobbers. Quotations remain unchanged as follows: Single carloads of wire nails to jobbers, $2.20, Pittsburg; to retailers, $2.30. Plain wire, carload lots, is quoted at $2.15 to jobbers and $2.25 to retailers; painted barb wire, $2.50 in carload lots to jobbers and $2.60 to retailers; galvanized barb wire, $2.80 in carload lots to jobbers and $2.90 to retailers. Cut nails are held at $1.95, Pittsburg, in carload lots with 2 per cent off in 10 days.

OLD MATERIAL.—The Pennsylvania Railroad Co. will dispose, this week, of a large lot of old material. Dealers are eager to purchase, despite the fact that there is not a large demand. We revise quotations as follows: New Bessemer melting stock, $14 to $14.50, gross tons; old iron rails, $16 to $17; busheling scrap, $11 to $12; cast borings, $5.50 to $6; cast scrap, $13 to $14; steel rails, mixed lengths, $13 to $14, and short lengths $14 to $15.

COKE.—There is very little demand for furnace coke, and the shipments from the ovens are mostly being made on contracts closed months ago. There is a better feeling in foundry coke, which is quoted at $2.25 to $2.35. Furnace coke is held at $2, although this price can be shaded.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1522 MONADNOCK BLOCK, Oct. 2.

Buyers of iron and steel are still pursuing a cautious policy, and a waiting one in some branches of the trade, although one or two kinds of iron and steel are selling exceptionally well. There appears to be more hesitation because of the coming election as the day draws nearer, and many buyers give as a reason for not making large purchases a desire to wait until the election results are known. This hesitation doubtless was the cause of the shutting down of several departments of the Joliet works of the Illinois Steel Co. the latter part of last week. The billet and rod mills there were closed down last Saturday, and it is not known at the present writing for how long. There is a possibility, too, that other

plants of the company will be compelled to shut down shortly because of a lack of orders.

PIG IRON.—While some dealers report a largely increased tonnage for the week just closed, others report a light business, no larger than has been the rule for several weeks past. The total of the week will probably show a considerable increase over any week recently. Among the orders closed were several for 1,000 and 2,000 tons each. The smaller business predominated, however, and aggregated a considerable amount. Most of the consumers in this territory continue to buy in a hand-to-mouth fashion, and it is not believed that the majority of them will adopt any different plan before election. The total amount of business done every week is good, and keeps shipments almost if not quite up to normal. The market is unchanged from a week ago. Furnaces are obtaining full prices in more cases than was the rule three or four weeks ago; but there are still reports of prices being named considerably under our quotations, and undoubtedly some buyers have made contracts at such figures. Notwithstanding this the larger furnaces make no reductions and are still securing a good share of the business being placed.

Lake Sup. Charcoal	$18 00 @ $19 00	Southern Coke No. 4	$13 85 @ 14 35
Local Coke Fdy. No. 1	15 50 @ 16 00	Southern No. 1 Soft	15 85 @ 16 35
Local Coke Fdy. No. 2	14 50 @ 15 00	Southern No. 2 Soft	14 85 @ 15 35
Local Coke Fdy. No. 3	14 00 @ 14 50	Southern Silveries	17 35 @ 17 85
Local Scotch Fdy. No. 1	15 50 @ 16 00	Jackson Co. Silveries	20 30 @ 21 30
Local Scotch Fdy. No. 2	14 50 @ 15 00	Ohio Strong Softeners	15 80 @ 16 80
Local Scotch Fdy. No. 3	14 00 @ 14 50	Alabama Car Wheel	20 30 @ 20 80
Southern Coke No. 1	15 85 @ 16 35	Malleable Bessemer	15 00 @ 16 00
Southern Coke No. 2	14 85 @ 15 35	Coke Bessemer	15 00 @ 16 00
Southern Coke No. 3	13 85 @ 14 85		

BARS.—The market has changed very little in the week. The consolidation mills have been after business to some extent, but not a great deal had been closed, and no especially large contracts were taken. Prices for iron remain unchanged at 1.30c to 1.40c, while steel is a little lower at 1.30c to 1.35c, Chicago, half extras.

STRUCTURAL MATERIAL.—No large contracts were closed, but there was a fair amount of small business taken, and there is more of it in sight. Quotations are as follows: Beams, 15 inches and under, 1.65c; 18 inches and over, 1.75c; angles under three inches, 1.40c to 1.45c; over six inches, 1.65c; three inches to six inches, 1.55c; plates, 1.25c to 1.35c; tees, 1.70c; zees, 1.65c; small lots from store are quoted ¼c to ½c higher.

PLATES.—The market is a little weaker than at last report, and has been quiet, with no noteworthy large sales. Some of the mills maintain the same prices as were quoted last week, but others have lowered their figures somewhat. Quotations are made as follows: Mill shipments, Chicago delivery: Tank steel, 1.25c to 1.35c; flange, 1.35c to 1.40c; marine, 1.45c to 1.50c; fire box, 2.25c and up, according to brand.

RAILS AND TRACK SUPPLIES.—The local mills took orders for about 30,000 tons of rails last week, including one contract for 13,000 tons, this being the requirements for next season of the purchaser. Other large business is in sight, but it is not expected a great deal of it will be placed for the next two or three weeks. Last year the large buying did not commence until the last of October, and that was a month earlier than in the year previous. Track fastenings are somewhat lower in the past week. Quotations are made as follows: Rails, standard sections, $26; light sections, $25 to $28; splice bars, 1.40c to 1.50c; spikes, 1.65c to 1.75c; track bolts, hexagon nuts, 2.05c to 2.10c; square nuts, 2c to 2.05c.

SHEETS.—There continues to be a good trade from consumers and several large contracts were closed last week. Jobbers are not buying so heavily, but still did a fair week's business with the mills. Galvanized sheets are somewhat higher at 70 and 10 per cent discount, with 18c freight allowance. No. 27 black sheets are quoted at 3.10c to 3.20c.

MERCHANT STEEL.—Inquiry has hardly been as active and sales were somewhat lighter than in the week previous. Most of the larger buyers have placed their requirements for the present. The market is firm, and some mills are asking a little more money. Usual quotations are unchanged, however. Mill shipments, Chicago delivery, are quoted as follows: Smooth-finished tire steel, 1.80c to 1.90c; open-hearth spring steel, 2.25c to 2.50c; toe calk, 2.50c to 2.65c; sleigh shoe, 1.75c to 2c; cutter shoe, 2.50c to 2.65c; ordinary tool steel, 7c to 8c; specials, 13c and upwards.

MERCHANT PIPE.—The demand has been light, and did not include any very large orders. Quotations are made as follows for random lengths:

MERCHANT PIPE.

	Carload lots. Black Per cent.	Carload lots. Galv. Per cent.	Less than carload lots. Black Per cent.	Less than carload lots. Galv. Per cent.
⅛ to ⅜, and 11 to 12 in.	59.2	46.2	54.9	40.9
½ to 10 inches	66.7	54.2	61.9	48.9

WIRE AND WIRE NAILS.—September was the best month of the year, in point of both sales and shipments, for the American Steel & Wire Co., and Saturday's sales were the largest for any one day in the history of the company. The demand for all kinds of wire goods is excellent and sales are very large. The market is firm and unchanged. Makers quote single carloads of wire nails at $2.48 f. o. b., Chicago, and $2.63 for less than car loads. On wire, current quotations are as follows: Plain annealed wire, $2.43; painted barb wire, $2.78; galvanized barb wire, $3.08.

OLD MATERIAL.—Very little business has been done, and there is not a great deal in sight. The bar mills have not yet been large buyers, and claim to be well supplied with material for some time to come, so they will hardly be in the market immediately. Other business is of the small lot variety entirely. Dealers selling prices, per gross ton, are as follows:

Old iron rails	$14 50 @ $15 00	Country malleable	$ 9 00 @ $10 00
Old steel rails, long	12 00 @ 12 50	Iron axles	17 00 @ 17 50
Old steel rails, mixed	10 00 @ 10 50	Cast borings	4 00 @ 4 50
Relaying rails	20 00 @ 22 00	Wrought turnings	6 00 @ 7 00
Old wheels	14 00 @ 15 00	Iron axle turnings	8 00 @ 8 50
Railroad forge	14 00 @ 14 50	Steel axle turnings	7 00 @ 8 00
Dealer's forge	11 00 @ 11 50	Mixed country steel	7 00 @ 8 00
No. 1 cut mill	10 00 @ 10 50	Stove plates	7 50 @ 8 00
Heavy cast	12 00 @ 12 50	Heavy melting steel	9 00 @ 10 00
Railway malleable	10 00 @ 11 00	Old iron splice bars	14 00 @ 15 00

CLEVELAND.

OFFICE OF *The Iron Trade Review*,
CAXTON BUILDING, Oct. 3.

Conditions in the ore trade are unchanged. No new ore buying is announced, and there is no indication of additional purchases. A few lots of unsold ore are being brought down by producers who consider present freights favorable to a little speculation on the election and the increased demand that will follow its favorable outcome.

PIG IRON.—In the Mahoning valley one rebuilt furnace is nearly ready to go into blast. In the Shenango valley two furnaces at Sharon have recently gone out. There is no immediate prospect of idle merchant furnaces resuming. Bessemer stocks continue heavy, and one large interest, heretofore a buyer of Bessemer, is now selling iron to the malleable trade, which is practically the only buyer at present, apart from an occasional order from an open-hearth plant. The Pittsburg market is now $13.50, the equivalent of $12.60 at valley furnace. On foundry iron the range of quotations is $13.50 to $14 in the valley, though furnaces naming the latter figure are not getting business. There has been more activity in foundry iron and some 500-ton orders have been sprinkled among the 50-ton and 100-ton business. Foundries are melting more iron, and report a noticeable improvement in orders. Forge iron is inactive, the recently started mills having stocks carried over that will last for some time. We quote $12.75 at valley furnace. Southern iron is about 50 cents higher. We quote the Cleveland market:

Bessemer	$13 50	Valley Scotch No. 1	$15 00 @ $15 50
No. 1 Strong Foundry	15 00 @ 15 50	Valley Scotch No. 2	14 50 @ 14 75
No. 2 Strong Foundry	14 50 @ 14 75	Gray Forge, valley	12 75 @ 13 00
No. 3 Foundry	14 00 @ 14 25	Lake Superior Charcoal	17 50 @ 18 00

FINISHED MATERIAL.—Rail inquiry is large, both for steam and electric lines, and this is the principal feature at present. For Northern Ohio electric lines alone 20,000 tons of rails are under inquiry, and the steam roads are figuring on liberal requirements. In respect to other products the situation is as last reported, except in sheets, which are quoted from $1 to $2 a ton higher. On blue annealed sheets we quote mill prices as follows: No. 10, 1.50c; No. 12, 1.60c; No. 14, 1.70c; No. 16, 1.80c; No. 18, 2c to 2.10c. For No. 27, one pass through cold rolls, 2.80c at mill is now asked, and for No. 28, 2.90c. The sheet mills are generally well supplied with orders. The plate market continues weak, though with recent business on steel car account greater firmness is now anticipated. We quote 1.10c on tank steel in small lots and 1.05c on large orders. Bar mills are running very full. Manufacturers of steel bars are quite firm in holding for 1.15c at Pittsburg mill; on small orders some are asking 1.20c. Bar iron is quoted 1.25c at valley mill. Cleveland sales are made at 1.40c to 1.45c out of stock, half extras. Specifications on contracts for structural steel are coming in with some freedom, but

new business is not plentiful. The Pittsburg basis of 1.50c on beams and channels up to 15 inches is maintained.

WIRE AND WIRE NAILS.—About 75 per cent of the full capacity of the Cleveland mills of the leading producer is now being operated. The demand is good and the outlook has improved in the past few weeks. We quote Cleveland deliveries to retailers in carload lots as follows: Wire nails, $2.40; plain wire, $2.35; galvanized, $2.75; barb wire, painted, $2.70; galvanized, $3.

PHILADELPHIA.

Oct. 2.

With no pronounced tendency developing, the market is closely watched by consumers, who are buying more iron because their trade is improving. Business seems slow, but the week's aggregate is large, and in any ordinary time there would be no thought of complaining. There is no swing to the business, and after the experience of last year, especially in the first half, there is a disposition to be dissatisfied with a cautious, conservative pace. There is no aftermath from such a market, to give any reason for apprehension Some satisfaction is found in a level from which there is no danger of a reaction. In general, prices are easier than at this time last week. The basis for steel rails has been much discussed. Being above the preliminary guesses made in some quarters, there is expressed the sentiment that the $26 price may be a tentative one designed to sound the railroads. But there is now less inclination to believe that it is temporary. Requisitions are expected shortly for round tonnages from Eastern roads, and it is believed the next few weeks will bring a good beginning in the buying for 1901 from roads both east and west.

PIG IRON.—A larger tonnage than for some weeks is reported, but with no improvement in prices The market is unquestionably easier and minimum prices are the commonly realized prices. The coal strike has not affected production as yet, but its long continuance will mean the banking of furnaces whose fuel is wholly or largely anthracite. A considerable fraction of current orders is shipped from furnace stocks, and the fact of lessening their piled iron leads some sellers to make inside prices. There are furnace companies which would prefer to losing orders to getting them on the basis of some of the prices that are reported; and in territory outside of this city where furnaces in other districts have access at low freights there are even lower prices than are heard in Philadelphia and nearby points. From New York a report comes of a 10,000-ton inquiry from an important consuming interest. We quote deliveries in Philadelphia and within 100 miles at the following figures: No. 1X foundry, $16.50 to $17; No. 2X foundry, $15.50 to $16; No. 2 plain, $14.75 to $15; gray forge, standard brands, $13.75 to $14.25.

FINISHED MATERIAL.—An easier feeling is noticed, particularly in plates and bars. The starting of the Western mills is regarded as a bear argument, bringing competition, where Eastern mills have for some time had the field to themselves. There is more than fair activity, but the relation of consumption to the new scale of production is not clearly established. Buyers believe material will be plentiful in the balance of the year; but if buying should quicken after election there is a chance for firmer prices. Plates continue to be in good demand and shipyards will be occupied for months to come. Mills in all lines are quite well fixed for orders, many being supplied for two months to come. We quote best refined bar iron at 1.30c to 1 35c; steel bars, 1 25c to 1.30c; tank plates, 1.25c to 1.30c; beams and channels, 15-inch and under, 1.60c to 1.70c; sheets, No. 12, 1.80c; No. 14, 1.90c; No. 18, 2.20c; No. 20, 2.30c; No. 24, 2.50c; No. 27, 2.70c; No. 28, 2.80c.

OLD MATERIAL.—There is an ample supply in most lines. Dealers are trying to get better prices, but find this difficult. We quote as follows: Choice railroad scrap, $14.50 to $15; No. 1 yard scrap, ordinary, $13 to $13.50; No. 2 light scrap, $10.50 to $11; machinery cast, $13.50 to $14.50; heavy steel scrap, $12 to $12.50; old iron rails, $14.50 to $16; old steel rails, $12.50 to $13.25; wrought turnings, 8.50 to $9; cast borings, $6.75 to $7.25; old car wheels, $17 to $18.

BIRMINGHAM, ALA.

Oct. 1.

Considerable improvement is noted in the local iron market and prices are firmer than for some time past. An official of one of the furnace companies states that his company sold more iron last week than it made, and the movement from the yards was greater than the output. This is the first time since the beginning of June that any company in this district has reported weekly sales greater than the make for the week. The same official states that the prices obtained for the iron sold was at approximately the quoted prices. The sales were all for small amounts, the biggest sale made being for 400 tons. All the iron sold was for immediate delivery and goes directly to the consumers. Local quotation are as follows: No. 1 foundry, $12 to $12.50; No. 2 foundry, $10 to $11; No. 3 foundry, $10.50 to $11; No. 4 foundry, $10; gray forge $9.50 to $10; No. 1 soft, $12 to $12.50; No. 2 soft, $10 to $11. There appear to be two sets of sellers, with more than usual variation in prices. However, the lowest quotations are now less frequently made. Local manufacturers state that they do not anticipate much improvement in the iron market until after the presidential election, but they claim that bottom prices have been reached.

The export business has dropped off considerably in the past two weeks, the high ocean freight rates and the reduction of nearly $2 a ton in iron in Europe temporarily stopping the sales for export. There is, however, a large number of orders for export iron on the books of the local companies and the shipment of these will take all the available ship room for several weeks yet. It has been stated that all the ship room available to Jan. 1, 1901, has been engaged for this purpose. The export shipments for the month of September are estimated to have aggregated about 30,000 tons.

The two local rolling mills of the Republic Iron & Steel Co. will be started up today. They have been idle since July 1, the date of the expiration of the old contract between the company and the Amalgamated Association of Iron, Steel and Tin Workers. The two mills employ about 2 000 men. They will not be run on full time for a few weeks yet.

T. H. Aldrich has tendered his resignation as vice-president and general manager of the Sloss-Sheffield Steel & Iron Co., to take effect today. Priestly Toulmin has been appointed general manager in charge of furnaces, coal mines, coke ovens, engineering, etc. The office of general agent in connection with the traffic and sales department has been created, and A. G. Palmer, formerly in the traffic department of the Peoria, Decatur & Evansville road, has been appointed to fill it. President E. O. Hopkins announces in a circular that M. J. Lewis has been appointed assistant to the president, a new office. Secretary and Treasurer J. W. McQueen and Auditor C. H. Schoolar retain their places under the new management.

Brown Hoisting Machinery Co.

The above company has issued a circular, under date of Oct. 1, stating that on that day it accepted the assignment and transfer by the Brown Hoisting & Conveying Machine Co., Cleveland, of its entire plant, business, property, accounts, contracts and assets of every description. The officers of the company are: Fayette Brown, president; Alex. E. Brown, vice-president; Harvey H. Brown, treasurer, and F. G. Tallman, general manager. The change is in pursuance of an announcement made a short time since of the reorganization of the well-known Brown Hoisting & Conveying Machine Co., and the formation of the new company with Delaware charter and $1,000,000 of preferred and $1,000,000 of common stock. The old company makes announcement of the change under date of Oct. 1, and says that the entire interests of its stockholders have been reinvested in the new corporation, together with a large addition of new capital. The move just consummated was in view of the great increase in the demand for the products of the company and the desirability of adding to the cash capital employed in its business.

THE New England Foundrymen's Association has accepted the invitation of the James Hunter Machine Co., of North Adams, Mass., to hold its October meeting in that city. The company has just completed a new foundry, the inspection of which will prove a pleasant feature of the gathering. The train bearing the foundrymen from Boston and vicinity leaves for North Adams at 9.30 A. M. Wednesday, Oct. 10, and returning leaves North Adams at 3 P. M. the next day

The furnaces at Pulaski City, Va., and Stone Gap, Va., were shut down last week to undergo extensive repairs.

FATAL VIOLENCE IN THE CLEVELAND STRIKE.

The first serious violence in the strike of the machinery molders of Cleveland, occurred on Saturday night, Sept. 29. Five non union molders were walking together on a downtown street when according to the story of one of them they were set upon by a group of union molders whom they passed. It is charged that one of the attacking party said as the non-union molders passed, "Let's kill the scabs." Revolvers were drawn and many shots were fired. A city detective who rushed in upon the combatants was shot and instantly killed. One of the union pickets, who had been on duty at the Union Depot for some weeks, was shot and died soon after in the hospital. A bricklayer, who went to the assistance of the police officers, died the next day from a wound received in the fight. Five non union men were arrested and are in jail charged with murder in the second degree. One union man is under arrest; the others escaped. There is a difference of opinion among the police, some of whom say that the non union men were set upon and therefore acted in self-defense. It is said that the detective who lost his life dropped his revolver in the struggle and that it was picked up by one of the non-union men who is accused of firing all three of the fatal shots. There is much conflict of testimony and very little that is clear. Other officers say that there is a good case against some of the accused, but do not give out any details.

Officers of both the National Foundrymen's Association and the Iron Molders' Union deplore the affair. The local foundrymen met on Monday to arrange bail for the non-union men, who are spoken of as excellent workmen, sober and inoffensive. Of the union picket who was killed officers of the Molders' Union say that he was peaceably disposed and had repeatedly urged that violence be avoided, and they are unwilling to believe him the aggressor. No action has been taken by the members of the union for the defense of their comrade who is in jail. Their officers say that no man will be defended in wrong doing. It does not appear that the tragedy has affected the strike situation. Nearly 200 non-union men are at work, living on foundry premises, all of which are picketed day and night by the strikers. Vice-President Valentine expresses the belief that the strike will be settled, and says there is really very little ground for so serious a struggle. He believes the men will win. On the other hand the employers say the strike is now discommoding them very little and that they are getting out good work and a better output per man than that to which they have been accustomed.

Obituary.

George F. McCleane, one of Pittsburg's pioneer iron manufacturers, died at the Monongahela House, Pittsburg, Sunday evening, Sept. 30. Though in his 76th year, Mr. McCleane enjoyed excellent health until a few weeks ago. On Sept. 1 he returned from the East where he spent the summer, and decided to remain during the winter in Pittsburg. Mr. McCleane was born in Delaware in 1826, and in 1852 he went to Pittsburg to enter the employ of his cousin, W. Dewees Wood, who had come a year previous from Philadelphia to found one of the great industries of the Pittsburg district. The works were at McKeesport and Mr. McCleane soon gained a thorough practical knowledge of the business. The firm of Wood, Moorhead & Co. was then formed consisting of W. Dewees Wood, M. K. Moorhead and George F. McCleane. It was in the works of this concern that the first galvanized sheet iron was made, and it was through the skill and practical knowledge of Mr. McCleane that it was produced. Shortly after this Mr. Wood withdrew from the firm, and it was reorganized as Moorhead & Co. It operated furnaces and mills at Soho, which were then the most extensive in the Pittsburg district. In 1887 the name of the firm was again changed, M. K. Moorhead and Mr. McCleane having incorporated the Moorhead McCleane Co., with W. J. Moorehead. The business of the company, under the practical management of Mr. McCleane, grew to large proportions. The company was one of those compelled to go into liquidation during the business depression of 1893-95 and Mr. McCleane then left Pittsburg to live principally in Philadelphia and Merchantville.

PERSONAL.

President Shaffer, of the Amalgamated Association says that in view of the letters that have come to him from members of the association since the announcement of his resignation, he is willing to recall it for the present if such service as his physical condition will permit is satisfactory to the association.

A. B. Farquhar, the well-known manufacturer of York, Pa., has declined the National party's nomination for president.

Andrew Carnegie's position in the present political campaign has been the subject of much newspaper comment first and last. Mr. Carnegie has written an article for the October *North American Review* in which, while still declaring his opposition to imperialism so-called he says that this policy is attended with less danger to the country than is the declared policy which would involve, through hostility to the Supreme Court and its decisions, license instead of law at home, the establishment of silver as the monetary standard, which means the reduction by half of the earnings of labor and of the people's savings, and an income tax which involves an espionage absolutely un-American.

Henry H. Quimby has resigned as chief engineer of the Phœnixville Iron Works, Phœnixville, Pa., and has established the Quimby Engineering Co. with office at 915 Ridge Ave., Philadelphia. The new company will engage in consulting (civil and mechanical) engineering, and will make the Shaw's mercury pressure and vacuum gauges succeeding Thomas Shaw.

THE two new blast furnaces now being built at the South Works of the Illinois Steel Co. are well along toward completion, and it is hoped they will be in condition to blow in within a short time. They are being built at the "new" furnace plant at the north end of the South Works. The dimensions of the furnaces are as follows: Height, 95 feet; diameter of bosh, 22 feet; diameter of hearth, 14 feet; diameter of stock line, 15 feet 6 inches; diameter of bell, 12 feet; height to center of tuyeres, 7 feet 6 inches; number of tuyeres, 11 7-inch. Each furnace has four 4-pass hot blast stoves, 25 feet in diameter by 100 feet high to top of dome. The heating surface is 56,000 square feet. There will be five blowing engines, of the horizontal cross compound type, built by the Mesta Machine Co., of Pittsburg. The steam cylinders of the engines are 44 inches by 84 inches by 66-inch stroke; the blowing cylinders are 84 inches by 66-inch stroke. They are equipped with the Weiss condenser.

THE Lima Steel Casting Co., of Lima, O., maker of open-hearth steel castings, has opened an office at 1522 Monadnock Block, Chicago, under the management of C. R. Robinson, to cover the Western trade. The company makes a specialty of steel castings for electrical, mining machinery and automobile work. Mr. Robinson was connected with Park Bro & Co.'s Chicago office for five years, and later with the Chicago office of Singer, Nimick & Co., as traveling salesman for their steel products.

THE Anderson, Ind., plant of the American Steel & Wire Co. resumed operations this week after an idleness of many months.

IT is reported that the Pennsylvania Steel Co., Steelton, Pa., has been awarded a contract for 6,000 tons of steel rails for delivery in India. The East Indian Railway Co., of India, is the reported purchaser.

THE American Automatic Filter & Sewage Purifying Co., of Pittsburg has applied for a charter, with a capital of $50,000. The incorporators are: James Prescott, N. Lanser, C. A. Muehlbronner, P. A. Didier, and J. M. Prescott, Jr. The company will commence the manufacture of a new automatic filter, the invention of Nicholas Lanser.

AFTER being closed for four months the Nes Chain Works, of York, Pa., will resume operations Oct. 8, with a full force of 100 men. The plant belongs to the Standard Chain Co., of Pittsburg.

The National Steel Co. has just shipped 4,000 tons of open-hearth steel blooms from its Sharon, Pa., plant to Germany, to be used in the construction of vessels.

THE IRON TRADE REVIEW
AND
INDUSTRIAL WORLD.

DEVOTED TO MACHINERY, METAL-WORKING AND FOUNDRY TRADES AND IRON AND STEEL MANUFACTURE.

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THE RULE OF THE FOUNDRY SHOP COMMITTEE.

Reference was made in these columns some time ago to the policy of the Iron Molders' Union in restricting output, and in illustration of the union's practice we reprinted a notice received by a molder summoning him to appear before a local union to answer to the charge of "overdoing a day's work." What was then said in criticism of this attitude of the union has called out statements from the organs of two influential unions—the Amalgamated Association of Iron and Steel Workers and the Iron Molders' Union. The articles would take more space than we can spare, otherwise we would be glad to reprint them as representing presumably the best that can be said by the unions in explanation, if not in justification, of their restrictions upon output. The striking thing about the two explanations is that they do not agree. The one lays stress upon the necessity of such limitations by a union as will protect the "health and morals of its members" and save them from the exactions of taskmasters, and compares these regulations to the police powers of the humane society which protects animals and children against cruelty. This thought the writer elaborates and enlarges upon. The other defender of the unions against the charge of hostility to progress, does indeed agree in saying that "preventing an unfair employer from making slaves of his employes" is an object of these shop rules defining a day's work; but the real purpose, which the other writer discreetly avoids mentioning, is frankly stated later on in this sentence: "A labor organization's chief aim is to divide work up so that all men may be employed at living wages."

That is exactly the understanding we have of it. In undertaking such a program, on the face of it a benevolent one, the labor unions have put themselves squarely across the path of progress, and in their practical working out of their theory have fallen into the very abuses to which we have already called attention. Stated in other words, the undertaking of the unions is so to control all instruments of production—all machinery, all skill, all muscle—as to give the largest number of men work for the longest time. No squarer antagonism to the modern idea of multiple production could be conceived. As practically carried out it has meant antagonism to machinery or to the modern system of attaining large outputs by sub-divided operations, for the immediate tendency of these is to concentrate work in fewer hands rather than make it go around. Hence the trades union opposition to machinery, which though giving way steadily to more intelligent counsels, had one of its illustrations until recently in the hostility of union molders to the molding machine. It is to be said of all artificial checks upon intensified production that they are short-sighted and narrow, for in their opposition to labor saving machinery they ignore the familiar fact that machinery and improved methods cheapen product, increase consumption and ultimately increase the demand for labor.

The fundamental defect of shop committee limitations upon individual output is that it applies a different rule to the employe from that to which the employer is constantly subjected. Competition fixes the status of the employer and governs his choices. How can he maintain his position in the face of a policy by the union which presupposes that there is a certain fixed supply of work for the shop and that the union's duty to its members is to make it go as far as possible among the men? In practice the limits set by the molders' union leave out all knowledge the proprietor or his representatives may have of market conditions, of what competitors are doing, or of the demands that must be met if the work is to be retained. This course is as unreasonable as that of the employer who assumes to be the sole arbiter of questions of wages, hours and output. We recall now one instance of many that indicate the arbitrary manner in which union regulation of output is applied in practice, whatever the theoretical grounds on which it is justified. A well equipped foundry, unable to get out all its work, sent certain patterns to another foundry, also well equipped. Both foundries were built in the last few years and had modern appliances. One was an open shop; the other, to which the patterns were sent, was under union control. Twenty-two castings a day had been the regular record in the first shop on the pattern in question. On its arrival at the second foundy the shop committee met, inspected it and decreed that eight castings should constitute a day's work!

It will not do to say that anybody was being protected against a slave-driving foreman, or that the shop committee was making proper allowance for the failure of the one foundry to provide conveniences and expediting appliances. It was simply a case of three men, clothed with power to which they were not entitled, carrying out in the spirit of the union, one of its fundamental policies. They decided in advance, without experiment, without any data on which to base their conclusion, what would be a "fair day's work." In the various modifications of the premium plan of piece work in vogue in many shops, there is thorough

experimenting with men of varying capacities, and with machines of different makes, to arrive at data from which an average day's work may be determined. Every effort is made to get a fair basis from which premiums for greater output and for perfect and regular product are to be reckoned. The molders' shop committee goes through no such tedious procedure. It has a far speedier and more satisfactory way. Visual inspection of the pattern dispenses with all troublesome groping after a basis. For the shop committee to say the word makes it so, and what could be swifter or more certain?

Cover it over as its apologists may, the committee method of restricting output, as it is now practically carried out, is unjust and at variance with the spirit of progress that dominates all successful industry. It is a crude attempt to graft upon the competitive system a sprig from the tree of socialism. If the Marxian regime were in full force, and there were a universal shop committee that adjusted output to consumption and fixed by decree from which there could be no dissent, the price of the product and the pay of the workman, the case would be different. But such a consummation is exceedingly remote. Meantime employer and employe are under stress of the same inexorable law, which tends toward a maximum of output with a minimum of labor.

THE August statement of iron and steel exports shows a gratifying increase over August, 1899. The steel rail shipments were 33,968 tons, or at the rate of 400,000 tons a year. There was a noteworthy gain in billets, also—from 92 tons to 10,440 tons, and in structural material. As the table below shows, the aggregate is far beyond that for August, 1899, when home consumers greedily took everything in sight. Steady gains may be expected from this time on, but the lack of ocean bottoms will long be a serious drawback. No feature of the iron trade to-day so insistently calls for attention and remedy, as the inability of furnacemen and steel makers to get ocean room when they want it and at reasonable prices. The August total of iron and steel exports, including machinery, was not much above that for August, 1899 in value, owing to the great fall in prices—$10,888,241 against $10,317,446. It is worthy of note, however, that we are now regularly sending abroad more than $10,000,000 worth of iron and steel and machinery every month. For the eight months ending with August the total was $87,174,389, against $68,008,070 for the first eight months of 1899, and $52,925,082 in the corresponding period of 1898:

EXPORTS OF IRON AND STEEL FROM THE UNITED STATES.

Gross Tons.

	August.		Jan'y—August.	
	1899	1900	1899	1900
Pig iron { ferro			13	16
Pig iron { all other	14,474	30,965	177,342	120,696
Scrap	6,360	5,267	63,544	30,536
Bar iron	1,510	588	8,368	4,808
Wire rods	1,024	237	14,114	4,778
Steel bars (not wire rods)	1,271	13,810	23,000	37,667
Iron rails	106	53	5,200	4,703
Steel rails	29,436	33,968	158,937	256,276
Billets, ingots and blooms	92	10,440	24,579	39,618
Hoop, band and scroll iron	89	279	2,075	836
Iron sheets and plates	236	322	4,481	6,250
Steel sheets and plates	3,412	5,302	3,995	22,864
Tin plates, terne plates, and tagger's tin	23	5	91	4
Structural material	3,283	8,404	37,762	46,702
Wire	11,715	4,863	74,939	55,247
Cut nails	814	706	6,279	7,782
Wire nails	2,913	1,985	20,083	21,956
Other nails, including tacks	171	207	1,595	1,307
	76,929	117,401	626,310	653,046

IRON AND STEEL STOCKS.

The table below snows the changes in the iron and stee stocks in the week ending Sept. 29, also the high and low points for the year, as reported by Denison, Prior & Co., of Cleveland:

Name.	WEEK. Sept. 22. Close	Sept. 29. High	Sept. 29. Low	Sept. 29. Close	YEAR. High.		YEAR. Low.	
Am. Car & Fdy	14	14¾	13⅝	14	18	Feb. 7	12⅝	Jan. 15
Am. Car & Fdy pr.	58¾	60	57⅞	59⅛	67⅞	Apr. 2	57⅞	June 25
Am. Steel & Wire	29⅛	31⅝	29⅛	31	59⅞	Apr. 2	28⅛	June 25
AmSteel & Wire pr	70⅞	71⅝	70	71⅛	95	Feb. 1	69⅛	June 25
Am. Steel Hoop	17	19⅜	17⅛	18	50⅝	Feb. 6	17	June 25
Am. Steel Hoop pr	65	65¼	64¼	64¼	86	Feb. 6	64¼	Sept. 28
Am. Tin Plate	24¾	27	24	27	36⅛	Feb. 7	18	June 25
Am. Tin Plate pr.	79	79⅜	77	79½	84⅞	Apr. 9	70⅛	June 25
Col. Fuel & Iron	29¼	39½	29¼	30⅜	51⅞	Apr. 2	29¼	Sept. 24
Federal Steel	30⅜	32½	30½	32	57⅝	Feb. 6	28⅝	June 25
Federal Steel pr	65	66	63¾	65½	77⅝	Feb. 6	60¾	June 26
National Steel	24	25¾	23½	24¾	53⅜	Feb. 6	20	June 23
National Steel pr.	82¾	83	.....	.....	97	Feb. 6	79⅝	June 26
Pressed Steel Car	35¼	35¾	32½	34⅝	58¾	Jan. 17	32½	Sept. 26
PressedSteelCar pr	71	71	70½	71	88⅛	Jan. 17	70⅜	Sept. 26
Republic Steel	10	11⅜	10½	10⅝	27⅛	Feb. 6	8¾	June 26
Republic Steel pr.	50¾	52	51½	51½	70⅞	Feb. 6	49	Aug. 1
Tenn. Coal & Iron	55⅞	57	51	55⅛	104	Feb. 2	51¼	Sept. 25

Damage Suit Over an Ore Contract.

The suit brought by the Thomas Iron Co., of Easton, Pa., against the Jackson Iron Co., of Negaunee, Mich., was concluded in circuit court at Marquette, Mich., last week. A verdict of $21,891.48 damages was returned by the jury. The suit concerned the non-delivery of between 8,000 and 9,000 tons of ore which the Jackson Iron Co. had agreed to furnish the complainant's furnaces in the fall of 1899. The non-receipt of this ore put the Thomas Iron Co. to great expense and trouble to obtain its equivalent from other sources, and it was found that the substitution of other ores resulted in a curtailment of production, an increased cost per ton for the manufactured iron and substantial damage to the stacks. These points were brought out in the testimony. The judge charged the jury to bring in a verdict for the plaintiff. The amount asked was much larger than the finding, and the jury spent eight hours in arriving at a compromise on the amount returned.

A Stove Manufacturers' Consolidation.

On Tuesday, Oct. 16, representatives of nearly 400 stove foundries in the country will meet in Chicago for the purpose of considering a proposition to form the National Stove Mfg. Co., a Delaware charter for which has already been secured, with a capital of $60,000,000. John W. Baker, a Philadelphia attorney, is promoting the enterprise.

THE Pittsburg Steel Foundry, whose works are at Glassport, Pa., and office in German National Bank Bldg., Pittsburg, has opened an office in the Real Estate Trust Co.'s Building, Philadelphia, and has appointed Duncan MacDougall as general Eastern sales agent, to represent the company in all the Eastern States.

THE Standard Steel Car Wheel Co. had its articles of incorporation recorded in New Jersey last week. The authorized capital stock is $100,000, and $1,000 is paid in. The incorporators are S. T. McCarthy, Alfred G. Brown and G. W. Mark.

AT the end of September there was in the yards of the American Pig Iron Storage Warrant Co., 21,800 tons of pig iron, 1,600 tons having been put in yard in the preceding 10 days and none withdrawn. On Sept. 23, 1899, the stocks in yards amounted to 22,500 tons; on Sept. 30, 1898, to 215,600 tons, and on Sept. 30, 1897, to 265,100 tons.

IT is reported that the association of which all the large manufacturers of brass in the United States were members, dissolved on Oct. 1. Hereafter there will not be a price agreement among the manufacturers.

THE Carnegie Steel Co. will add to the finishing department of the Edgar Thomson plant at Braddock a number of straightening beds.

THE Grant Tool Co., Franklin, Pa., was granted a Pennsylvania charter last week with a capital of $600,000. The principal stockholders are John J. Grant and Gen. Chas. Miller.

A NEW UNION IN THE METAL TRADES.

A new employees' organization has been started at Columbus, O., which in time may become a factor of some importance in the metal trades. It is known as the Machine Trades and Professions Association, and its active membership is made up from those trades directly connected with the construction and maintenance of machinery, namely, patternmakers, molders, blacksmiths and machinists. Provision is made for an honorary membership, which may include manufacturers, superintendents, draftsmen, chemists—in fact any who are sufficiently interested to join and aid in carrying out the objects of the association.

The platform of the association is, broadly, the community of interest between employers and employes, as opposed to the idea of essential antagonism between manufacturers and wage earners, which is at the foundation of present trade unions. Opposition to strikes, lockouts and boycotts is a cardinal feature of the new association, and the cultivation of such relations between employers and employes as shall facilitate the peaceful and just settlement of all questions that may arise affecting the rights, privileges and duties of either side. At present the Columbus organization is purely local, and its most important work has been to prepare and to secure the adoption of a working agreement with the Metal Trades Association of Columbus. The work of the latter organization was described at length in our issue of April 12. The originators of the Columbus movement have also established a branch in Cincinnati, and letters from mechanics in different cities have been received by the originators, asking for literature and requesting the privilege of establishing locals. As indicating more fully the aims and scope of the organization, we append the preamble and constitution:

PREAMBLE.

We, a representative body of mechanics engaged in the several trades necessary for the construction of machinery, in order to better qualify ourselves to promote the trades and professions connected with mechanical construction, and believing that upon the success of the employer depends the steady employment of the efficient employe, shall endeavor to use all honorable means to the success of both employer and employe, and for the social, moral and intellectual advancement of mechanics, we do adopt the following constitution.

CONSTITUTION.

Article 1. The name of this organization shall be The Machine Trades and Professions Association.

Art. 2. The membership of this association shall be composed of citizens of the United States engaged or interested in the manufacture and maintenance of machinery.

Art. 3 No member shall take part in any strike or boycott, except in a proper manner to defend himself against any such; neither shall any person be admitted to membership who belongs to any organization which in any manner countenances strikes or boycotts, unless previous to admission he shall renounce such connection and affiliation; and any member of this association who unites himself with any such organization does thereby sever his connection with this association, and it shall be so declared.

Art. 4. The objects of this association shall be to hold meetings for social intercourse and instruction, and the reading and discussion of professional papers, to circulate by means of publication among the members information thus obtained; and to provide ways and means, whereby members, by availing themselves of the advantages offered, may acquire proficiency, which together with moral principles, comprise the essential qualifications required in the highest standard mechanic.

Art. 5. As supply and demand, together with quality, govern remuneration, the question of manner of service and recompense shall be considered a private individual privilege of adjustment. But all questions not so adjusted may be referred to the officers of this association for arbitration.

Art. 6. This association shall not be used, in any manner, to further the interests of politics, except in so far as to encourage the enactment of laws for the benefit or protection of its members; nor shall it be used for religious purposes.

Art. 7. This constitution can be amended at the second July meeting of this association, by a two-thirds vote of all the members, provided the amendment was submitted in writing at the first regular meeting in the preceding month.

The new association looks to harmony and peace as the normal and continuous relation between employers and employes. The two classes are to be brought more closely together and their community of interest emphasized. The present unions are preaching hostility and the maintenance of a war footing as the only means of getting proper recognitio from their employers. There is no doubt of the growing feeling that the strike and the boycott on the one hand and the lockout on the other, are weapons which should be done away with; and the failure of labor unions to confine themselves to the use of legitimate means for correcting evils and obtaining their rights has been the starting point of the new movement.

In view of the opposition to compulsory arbitration in this country—though the New Zealand law has operated there with admitted success for eight years—all agreements looking toward arbitration are to be encouraged. This is the purport of the agreement just entered into between the Metal Manufacturers' Association of Columbus and the Machine Trades and Professions Association. Its terms are as follows:

WHEREAS, The said Metal Manufacturers' Association, a party hereto, is a voluntary association of manufacturers, and,

WHEREAS, The Machine Trades and Professions Association, also a party hereto, is a voluntary association of employes, and,

WHEREAS, The undersigned are a lawfully appointed committee duly delegated with authority to represent and bind the parties hereto, now therefore,

The parties hereto, believing in the principle of arbitration as opposed to strikes, lockouts and boycotts as a method for settling differences which may arise between employers and employes, do hereby recommend for ratification by the two organizations parties hereto the following agreement:

WHEREAS, The Metal Manufacturers' Association recognizes that questions affecting the general conditions of trades involved and of the individuals of those trades, may be equitably settled by reference to arbitration, and,

WHEREAS, The Machine Trades and Professions Association recognizes that strikes and boycotts are antagonistic measures contemplated to arouse opposition rather than peaceful and equitable adjudication, and,

WHEREAS, The Machine Trades and Professions Association and each of its members do agree collectively and individually to abstain from strikes and boycotts, and,

WHEREAS, The Metal Manufacturers' Association in consideration thereof, agrees to submit grievances of the Machine Trades and Professions Association to arbitration; now, therefore,

Resolved, That this committee, representing both parties hereto in conference assembled, endorses the principle of national arbitration; and be it further

Resolved That in all disputes hereafter to arise between members of these two organizations, that is between employer and employe, every reasonable effort shall be made by said parties to effect a satisfactory adjustment of the difficulty. Failing in which either party shall have the right to ask its reference to a committee of arbitration, which shall consist of the presidents of the Metal Manufacturers' Association and the Machine Trades and Professions Association or their representatives, and two other representatives of their respective associations, appointed by their presidents. The finding of this committee of arbitration by a majority vote shall be considered final as regards the case at issue. This committee shall convene within two weeks after reference of the dispute to them.

It is expected that the movement will come up for discussion and endorsement at the respective conventions of the National Founders' Association and the National Metal Trades Association. Expressions have been received from members of both associations indicating their desire to have the arbitration agreement extended to other cities, and to have unions established on the principles advocated by the Machine Trades and Professions Associations.

THE rod and billet mills of the Illinois Steel Co. at Joliet, Ill., were shut down last Saturday night, owing to a lack of orders. President E. J. Buffington made this statement regarding the shutdown: "We have shut down our Joliet mills for lack of orders. Possibly we shall be compelled to shut down other mills within the next ten days for the same reason, although we hope to continue most of our mills in operation. As the Presidential election approaches many of our best customers are postponing purchases, for the reason as they state, they wish to wait until they are certain of the result of the election before placing large orders." It is impossible to tell when the plant will resume work, although it will be as soon as sufficient orders come in to warrant resumption. It is possible the rod mill will be started up again within two weeks. The shutdown did not affect the merchant mill or the blast furnaces or any of the other departments, all of which are very busy. The Milwaukee plant of the company is also very busy, but there is a possibility the South Works will be closed shortly.

The plant of the Eureka Steel Works, Kokomo, Ind., will shortly be dismantled.

REPUBLIC IRON & STEEL CO.'S BESSEMER PLANT.

In the presence of a large company of officials and invited guests, the newly-completed Bessemer plant at the Brown-Bonnell works of the Republic Iron & Steel Co. was put in operation at Youngstown, O., on Sept. 27. The first blow passed off without a hitch and the first billet, 6x6 inches, was rolled two hours later. The smooth operation of the entire plant is highly creditable to S. V. Huber, of Pittsburg, who prepared the plans, and Samuel McDonald, the superintendent, who was immediately in charge of construction work. Among the officials who went from Chicago to witness the starting of the plant were President Warner, Vice-presidents W. E. Taylor and A. W. Thompson, Treasurer John F. Taylor and Secretary Ridgley.

The two 5-ton converters in the plant and other portions of its equipment were from the dismantled Bessemer plant of the company at Springfield, Ill. The 32-inch blooming mill was taken from the Alexandria, Ind., plant. The cupola house is of steel construction and was erected by the Youngstown Bridge Co., Youngstown, O. It is 72x40 feet. Of the four cupolas, three are from the Springfield plant and the fourth was built by the Meehan Boiler & Construction Co., of Lowellville, O. They have a capacity of 1,000 tons of metal in 24 hours. The hoist which conveys material to the charging floor is operated by an Otis vertical engine. The hoist is equipped with a safety device. The ladle cars are propelled over the narrow gauge track leading from the cupola building to the converter building by a cable passing over a Lidgerwood drum, the latter driven by a General Electric dust-proof motor.

The converter building is a steel structure 121x60 feet, erected by the Penn Bridge Co., Beaver Falls, Pa. A 10-ton hydraulic crane serves the two 5-ton converters which are of the following dimensions: 11 feet 7 inches extreme length, 7 feet ½ inch diameter, with opening of 3 feet 8 inches. In this building is a 5-ton overhead electric traveling crane, built by the Case Mfg. Co., Columbus, O. The manganese furnace was built by the Meehan Boiler & Construction Co. Scrap and manganese are carried to the charging floors by means of a hoist operated by a Crane vertical engine. The stripper building is a steel structure 30x60 feet, and contains besides ingot extractor, hydraulic manipulator and pulpit from which lever men operate the extractor. It was erected by the Pottstown (Pa.) Bridge Co. The pit furnace building is also of steel construction, 114x75 feet. It was also erected by the Pottstown Bridge Co. The pit furnaces are commanded by two 5-ton cranes built by the Case Mfg. Co. The furnaces were built by Alex. Laughlin & Co., of Pittsburg, Pa. There are two 4-hole furnaces of the most approved type, and fitted with all modern improvements. Furnace covers are operated by hydraulic power.

The blooming mill building is 204 feet long, and varying in width from 40 feet to 99 feet, built by the Penn Bridge Co., Beaver Falls, Pa. The mill is designed to roll down to 4-inch billets. The mill is driven by a Porter-Allen reversing engine, 28x48, direct coupled. The blooming mill tables were furnished by Heyl & Patterson and McGill & Co., Pittsburg. They are operated by a Macintosh-Hemphill horizontal engine, an Otis horizontal engine and a Siemens & Halske 30-h. p. motor. A 10-ton hydraulic crane is provided for roll-changing. The hydraulic bloom shears were furnished by the Lloyd Booth Co. and the steam shears by Macintosh Hemphill & Co. The vertical engine operating the latter also furnishes power for the billet conveyor.

The boiler house is a steel structure, 215x45 feet, by 36 feet high, erected by the Columbus Bridge Co., Columbus, O. It contains five Heine boilers, 250 h. p. each, and five batteries of Stirling water-tube boilers, 350 h. p. each—total capacity, 3,000 h. p. An 18-ft. steam main runs from these boilers to the blowing engine house; a 16-inch main to the blooming mill and a 6-inch main to the machine shop.

The gas producer building is of steel, 71x28 feet, and contains four gas producers of improved type erected by Alex. Laughlin & Co., of Pittsburg, fitted complete with reversing valves and all accessories.

The blowing engine and power house is of brick 110x55 feet. The three blowing engines are of the Porter-Allen vertical type, 36x48x48 inches. For the electrical equipment a Buckeye engine is provided direct connected to a 225 k. w. General Electric generator. For the three Baker blowers furnishing blast for the cupolas a Dick & Church tandem, compound condensing, automatic cut-off engine, 13x24x18 inches, is provided, built by the Phœnix Iron Works, of Meadville, Pa. There are also in this building two Gordon pressure pumps and two Wilson-Snyder pressure pumps for pumping water into the auxiliary tank which supplies hydraulic mains, etc. In the basement are four Gordon boiler feed pumps for pumping water to boilers. The auxiliary tank in this building was erected by the Meehan Boiler & Construction Co. The heaters and separators are of the Cochrane type, furnished by the Harrison Safety Boiler Works, of Philadelphia. A Siemens & Halske 15-h. p. motor operates drill presses used for taking samples of pig iron and Bessemer steel.

The pump house is a brick building, 35x21 feet and contains an Epping-Carpenter pump of 30,000,000 gallons capacity, which pumps water from well to standpipe, the latter constructed by Wm. B. Pollock & Co., of Youngstown. The machine shop equipment was furnished by the Marshall & Huschart Machinery Co., of Chicago and Cleveland. The blacksmith shop contains three forges, Buffalo blowers and a Curtis & Curtis pipe threading machine. In the bottom house, built of brick, 39x100 feet, is a Brown horizontal engine driving the grinding pan and crusher. There are four drying ovens and the building is stocked with refractories. An hydraulic jib crane handles converter bottoms on and off cars.

Welded Tubes That Experts Called Seamless.

Apropos the discussion which has been going on for some time between the manufacturers of seamless and welded boiler tubes and the government experts, it is interesting to note that experts of the French government have insisted, after making careful examinations of a shipment of lap welded boiler tubes shipped by the National Tube Co., that they are seamless and are demanding the payment of customs accordingly. During the months of May and June the National Tube Co. shipped 4,000 4-inch lap welded boiler tubes to the Compagnie Française Babcock & Wilcox, Havre, France. The tubes arrived at the custom house at Havre in due time. They were entered as lap welded, but the French customs officers had some doubts about the correctness of the entry and refused to pass them without a more careful examination. They were under the impression that inasmuch as the duty on seamless tubing is higher than on lap welded, the National Tube Co. was endeavoring to get the better of the government by making a false declaration. The experts were then called in, and after very careful examination and a number of tests it was decided that the tubes were seamless and not lap weld, and that customs must be paid accordingly.

In the meantime the Babcock & Wilcox Co. was anxiously awaiting the arrival of its tubes, but was informed that they could not be delivered until the duty on seamless tubing was paid. The Paris representative of the National Tube Co. was then requested to straighten out matters and to explain if possible to the government experts that, with all their tests, they had been working on a lap welded tube instead of seamless. An extract from his letter to the National Tube Co. explains the predicament: "We are having the devil's own time with the boiler tubes shipped to the Compagnie Française Babcock & Wilcox. The tubes are hung up in the custom house, the officials claiming that they are seamless, having had several tubes tested by French experts, who have testified that the tubes are really seamless and not welded. I have spent one week in Paris on the matter and am obliged to go to Havre tonight to take the question up further with the customs officials."

It might be stated that the specifications called for tubes made so that the weld does not show.

THE Spanish-American Iron Co., of Santiago de Cuba and New York, has been advised by Señor Gonzales de Quesada, special commissioner for Cuba, that its exhibit of ir was awarded a gold medal at the Paris Internatior tion. The exhibit consisted of several tons o iron ores produced by the company, together the same in several languages and many ; mines and property. Considerable quant pany's ores have already been used in l Germany and the United Kingdom.

ELECTRIC TRAVELING CRANES IN THE FOUNDRY.*

BY A. D. WILLIAMS, PITTSBURG, PA.

In nearly all foundries cranes are employed to do heavy lifting, and the overhead traveler, in most cases using electric power, has become a very desirable part of foundry equipment. The idea in this paper is to consider the multimotor electric crane from the user's standpoint, taking up its desirable and undesirable features, without attempting to give a detail treatise on crane designing. The only machines that never break down are those which are never used. Cranes are no exception to this rule, and the natural depravity of inanimate objects always causes the selection of such a time as will result in the greatest possible inconvenience to all concerned. Many serious crane accidents have occurred, and some of these are no doubt fresh in the memory of Pittsburg foundrymen.

The slings used in handling loads are really not part of the crane, but they are a source of trouble. Chain slings are the best, they are flexible, do not chafe, and damage to finished surfaces can easily be prevented by a little care in using. Their periodical inspection is necessary, and they should be annealed from time to time. Rope slings are liable to cut and are uncertain. In many places their use has been stopped, after an accident has cost more than a good set of chain slings.

For hoisting purposes chain is most commonly used on account of its flexibility. This means smaller drums and sheaves, and a higher hoist than can be obtained on the same crane with wire rope. Only the best grade of tested chain should be used, and if this becomes fatigued by long use, small cracks may develop. Its durability of course depends on the service the crane gets, and defects are not easily detected. Chains should be kept well lubricated, and annealed occasionally. Where wire rope is used its condition is readily seen, no expert being required. In this respect it is safer than chain. Extra flexible wire rope is manufactured which is well adapted to crane service on account of the moderate size of the sheaves and drum required. It is not an experiment for hoisting purposes, but its use on electric cranes is not as common as it would be if its good qualities were thoroughly appreciated. Hooks are made of various materials, forgings of wrought iron and steel are used in many cases, but malleable iron and steel castings are also employed. Malleable castings are only used for very light sections. For heavy work forged hooks are universally employed, and cast steel hooks have been used for medium size cranes. A first-class steel casting is much better than a poor forging, though the material to be specified is largely a matter of individual preferences. With proportions suited to the metal, it makes very little difference what is used, the chances of flaws are about even, and a burnt forging is not any more reliable than a defective casting.

Some cranes are so constructed that in hoisting and lowering the load is twisted more or less around a vertical axis. This necessitates extra care in its guidance. This style of hoist is not well suited for foundry purposes, as the attempt to correct this twisting can be very easily overdone with disastrous results. For the foundry a vertical hoist without any twist in it fits the bill best, and for almost all purposes is the most desirable.

Motors, Controllers and Wiring.

The electric motors, controllers and wiring on cranes should all be arranged and constructed so that repairs can be easily and quickly made. Perfect insulation is impossible, as all substances conduct electricity more or less. There are a number of grades of insulated wire, and a good quality run on porcelain insulators or in molding arranged so that no two wires can come in contact with each other or with any metal, should be insisted upon. Nearly all the electrical troubles with cranes arise from imperfect insulation. No detail is too small to be slighted in this respect, as fine dust and "flyings" are liable to settle anywhere, and a ground or short circuit from this cause may be expensive. Wooden battens should be used to prevent the trolley from swinging against the girders, but wood alone should never be depended upon as an insulator.

Crane controllers are important, as the entire manipulation of the machine depends upon them. This like the clutch of the mechanically operated crane is a weak point. The practically perfect crane controller is yet a matter of the future. All parts should be accessible, and so arranged that those subject to wear can be removed and replaced with a minimum amount of trouble. The resistance coils should be arranged so that close control over the crane can be obtained, as without it delicate handling is impossible. The device by which the operating levers are centered, or held in the position at which the current is off, should be so positive that the operator is not likely to throw the lever too far and reverse unintentionally. Any weakness in this device is a constant source of danger, yet it is desirable to have easy working controllers.

The electric motors used should be enclosed in dust-proof casings; those built for crane service by the large electrical concerns are very compact and accessible, their designers have had the benefit of wide experience gained in street railroad work, and the motors they produce give very little trouble. Standardization of all parts has been followed out, so that repairs are in most cases very simple, and extra parts can be carried in stock. Special motors are things to be avoided; a bill for repairs would furnish sufficient explanation. The armature and commutator of a motor are its two most vulnerable parts, and it is much easier to remove them when attention is required than to attempt their repair in place. In most cases removal is absolutely necessary. A set of spare armatures adds to the cost of a crane, but it will save a delay at an inopportune time, as slight faults can be corrected which, if given time to develop, would prove expensive.

Crane brakes or safety devices are of two kinds, one which acts upon the interruption of the electric circuit for any cause, the other operated by the load. The former is generally called the magnetic brake, because it is thrown out of action by magnetism, being thrown on by a spring or by gravity. The force of gravity is not very likely to fail; springs are not so reliable. The braking effect is obtained by a cast iron drum keyed to one of the shafts (preferably the armature shaft) where its effect will be greatest, and a brake strap acting on the drum. This strap is often made of sheet steel and its friction surface fitted with a renewable lining of wood, leather, or other suitable material. Naturally this brake strap requires adjustment from time to time to take up the wear. This brake is made single or double acting, its principal duty is to overcome the inertia of the armature and to stop the load promptly. It should, however, be of sufficient size to hold the load. The designing of one of these brakes presents some interesting problems. Too little of it is only an aggravation, and when too large it is troublesome and may twist a shaft in two by stopping one end before the other. A modification of the Weston disk brake has also been successfully used as a magnetic brake.

The load brake, variously called the automatic brake, safety retaining clutch, mechanical brake, etc., is made in a number of designs by different makers; the basic principal is the same in all. The tendency of the load to run down acts to set the brake, which is arranged to permit hoisting freely. In lowering, the motor acts against the tendency of the load to lock the brake, and the load cannot move until these two forces balance each other; the brake absorbs the acceleration of gravity on the load so that it can only drop at a speed proportional to that of the motor. It might be said that the motor has to push the load down; this does not describe the action accurately, but it is close to it. It is highly important that the operation of this device should be smooth, any irregularities in its action causes the load to descend in a jerky fashion, which means excessive strains in the whole structure, and tends to develop defects. While no apparently serious results may appear at the time, there is the ever present risk that some part may have been overtaxed and cause a seemingly inexplicable breakdown in the future.

Mechanical Factors.

The mechanical elements of a crane are very simple, a few gears, track wheels, shafts, the motors, drum, brakes and the necessary framing to support and hold the mechanism, is about all there is to the trolley, but it will not do to put this

*Prepared for the meetings of the Foundrymen's Associations, Wednesday evening, Oct. 3, 1900. The author is connected with the Shoenberger steel plant of the American Steel & Wire Co.

together in "any old way." The phrase, "in a workmanlike manner," is susceptible of various interpretations, as there is no particular standard, and each one must judge according to his own lights. It is hardly necessary to say that cost counts in cranes as in everything else. The crane builders are not in it for pleasure and the shop facilities as well as the number that can be built from one set of patterns is important, all changes add to their costs and the endeavor is to get up a set of standard sizes that will enable them to suit the general run of customers with most of whom the price decides the question. The maximum amount of trolley travel calls for a short trolley. The minimum of headroom can only be entered by a low trolley. The maximum amount of hoist can only be obtained by a trolley which can be placed close to the roof chords. Ease of repair requires that all parts shall be arranged so that any piece can be removed and replaced with a minimum amount of trouble and labor. All bearings should be capped, as shafting has a habit of getting bent so that it is impossible to remove it from a solid bearing without cutting it to pieces. With hack saws this is a tedious job, but it can be done very rapidly by burning the shaft in two by an electric arc, provided power enough is available. With capped bearings bent shafts can be removed and straightened, perhaps they ought not to become bent, but it does happen just the same. With cranes it is not easy to make repairs. The space to move around in is limited, and the risk of a tumble makes a man cautious, only one hand being often available .This fact is not as thoroughly appreciated as it should be by crane designers.

Crane gears are important items, particularly as they wear out in time. Cast iron gears, if properly proportioned, work well, but it is a good plan to have pinions of steel. In this combination the pinion wears out before the gear. In a great many cases a little more pig iron would improve the gears. Where this is the case cast steel can be used to advantage in making repairs, as owing to the limitations of space, etc., it is rarely possible to make any changes in the main dimension. Lightness is particularly important in a crane, as it counts in the girders requisite, but a crane that is too light is continually giving trouble, and in the long run it costs more than a heavier machine.

The Question of Safety Devices.

Safety devices of different kinds are occasionally employed to prevent over hoisting, and running the trolley or bridge full tilt into the end stops as commonly designed; their utility is questionable, for the crane operator can hold the circuit breaker in and at the same time use the controller to get back past the safety line. The best arrangement of such devices is to so place them so that the operator will have to call assistance to hold the circuit breaker in until he can run back to a point where it will stay closed. When the operator finds that he gets caught in this way it is only a matter of time before he discovers a way to get around the circuit breaker. Over hoisting generally brings a pretty good strain on the mechanism. It is very likely to result in broken chain sheaves and a bending of shaft. One accident of this kind is about all a crane operator should have charged up to him, and unless he loses his head the results are not very serious. Running the trolley or bridge into the end stops at full speed is a very efficient way of testing the strength of the crane girders and runway, but there is a certain amount of danger in it, so that it is not advisable to do this intentionally. It is an expensive job if anything fails, and more than one crane has refused to stop at the end of the runway. This accident has also been caused by high winds, showing that for a yard crane a good anchor is necessary. The longitudinal and lateral strength of a great many crane runways is much lower than it should be, as only the static loading is considered and the roof trusses are depended upon for sway bracing. As they are not designed for this, the whole building is easily swayed in both directions by the crane.

The track wheels are depended upon, in most cases, for keeping a crane in line, or square, on the runway. These wheels should be of the same circumference. Double flanged wheels of cast steel or cast iron with chilled treads are used; both materials give satisfactory service. Chilled tread wheels should have their flanges made in sand, as otherwise there is considerable liablity of the flanges breaking off, in case the crane gets badly out of line or the runway varies from gage. With steel wheels the liability of breakage is diminished. but being soft the tread is likely to wear. The flanges are sometimes rolled over and spread apart by a poor runway, this on driving wheels having a gear mounted on their hub forces the gear over so that it cuts into the truck beam. The removal of a steel wheel when this has occurred is a very pleasant piece of work. It is almost impossible to keep a crane absolutely in line or square, but if proper precautions are taken it is possible to get very fair results. The line shaft should be driven as nearly midway between its ends as practicable, and is preferably a little too large than too small. It may be well to say that what is large to one man may seem small to another. When the line shaft is driven near one end there is a certain amount of torsional spring to it that permits one end of the crane to lag behind, producing a racking action that does not improve the wearing qualities of the machine. This same effect can also be produced by starting the bridge travel suddenly with a heavy load close to one end. It is perfectly practicable to connect the girders and track beams so that this injurious racking tendency can be, to a large extent, overcome, but it is not often done.

Runways that are out of line or not level, or a combination of these two defects, do not have a good effect on a crane and cause excessive wear on the bridge driving mechanism The correction of runway imperfections is comparatively simple, but unless the structure is very thoroughly braced, it will soon be as bad as before.

Types of Crane Girders.

There are a number of types of crane girders, two connected at the ends being used for all except very light machines. The single webbed plate girder was extensively employed at one time. The bottom chord, however, has a tendency to vibrate considerably when the crane is in motion. This is increased by sudden starts and stops. The weight of the line shaft and motor causes torsional strains and the metal is not well distributed to resist them. Rapid starting and stopping increase these strains. This type of girder is not suited for high speed cranes unless sway bracing can be used; in this case the trolley is placed between the girders and runs on the bottom chord. Where the trolley runs on the top chord a system of auxiliary latticing can be used, making in effect two girders at right angles to each other and by this means a high degree of lateral stiffness can be obtained at the sacrifice of simplicity.

The double webbed plate or box girder is the simplest form used in crane work; the metal is well distributed to resist all the strains met in service, the rivets can all be driven by machine, the use of stiffeners for the web plates can be avoided by using distance pieces and bolts or long rivets to hold the webs. These girders can be made as stiff as desired laterally and vertically. Occasionally a girder of this kind is made very deep and light web plates used, but this sacrifices almost all the stiffness and is not very good practice. The principal disadvantage of the box girder is that there is no way to inspect or paint the inside. Lattice girders are used extensively for yard cranes on account of the small amount of exposed surface. They are also employed for long span indoor cranes. The trolley can be placed on either the top or bottom chord to suit the conditions met with. The failure of crane girders is comparatively rare, as they can generally hold a considerable overload; nevertheless it is not a good plan to use a crane for anything heavier than its rated load, as this has a tendency to develop weak spots that in the future may cause trouble. In some cases a five-ton crane has handled nearly twenty tons, but the operator was taking big chances of spoiling the machine and starting several funerals.

The effect of impact on cranes is often neglected. In rapid working these stresses may be equal to those due to the dead load, so that the factor of safety is only one-half of what it would be if these stresses were taken into account in the first place.

Some of the foregoing remarks apply to cranes that are not driven by electric motors, and it is hoped that some information useful to crane users and the prospective purchasers of the machines has been brought out. In the foundry, as well as some other places, it will be found that the electric overhead traveler furnishes no panacea for difficulties inherent in

the handling of heavy work, though it is a valuable accessory. A large part of its calls are for turning molds, lifting copes, etc., which are too heavy for the molder. Very often it is necessary to hold such a load for some time, while there may be other floors waiting and losing valuable time. The old foundry jib crane should not be discarded on the advent of the traveler, but rather should be reinforced by a number of light jib or post cranes so that the traveler can be used at its maximum efficiency on lifts proportionate to its capacity. A great many crane breakdowns are due to carelessness or forgetfulness on the part of the crane operator. For instance, he blocks the gearing with a bolt or nut while making some slight repair, then starts the machine and the firm sends out a rush order for new gears. It is a good plan to carry a set of spares for all parts likely to become disabled or worn out in service. This avoids expensive express charges, and the extra cost of rushed work. In ordering such spares it should be specified that each piece shall be properly marked so that it can be easily identified.

COMPRESSOR EXHIBITS AT PARIS.

Among extensive exhibits from the United States at the Paris Exposition are those of the Ingersoll-Sergeant Drill Co., of New York City. The company makes three separate exhibits of its air compressing, mining, tunneling and quarrying machinery. On the Champ de Mars in the Palace of Machinery and Electricity, it has established its headquarters in the midst of the United States Machinery section. Here one of the company's class H compressors is in operation supplying air for all the pneumatic tool companies' exhibits and the tubular despatch of the Batcheller Pneumatic Tube Co. This compressor has duplex steam and compound air cylinders. The former are 12 inches by 12 inch stroke, and the latter 18 inches diameter for low pressure, 12 inches diameter for high pressure and 12-inch stroke. The engine is of the well-known Tangye frame type, mounted on a solid base which contains a special cooler through which the air passes on its way from the low to the high pressure cylinder. In this way its temperature is reduced to about that of running water, and the work required to compress a given volume of air is considerably reduced.

In Group IV., Civil Engineering and Transportation, are found a small motor-driven compressor and some interesting models, all exhibited by the same company. This compressor has a single air cylinder 6x6 inches. It has, on its base, a 5-h. p. General Electric Co.'s direct current motor, to which it is geared with a single reduction. When running at full speed, about 150 revolutions per minute, it has a capacity of 28 cubic feet per minute to a pressure of 50 lbs. per square inch. This machine was installed by the United States Commission, to furnish air for operating models of the machinery used in the excavation of the Great Chicago Drainage Canal.

The main exhibit of the company is at Vincennes. Occupying a space 41x34½ feet, or about 1,400 square feet, in a prominent position, it has two compressors and all of its mining and quarrying apparatus in the form of rock drills, coal cutters, and channeling apparatus. The largest compressor, Fig. 1, occupying one side, is of the horizontal cross compound Corliss type, with steam cylinders 12 and 22 inches and a 30-inch stroke. The low pressure air cylinder is 16¼x30 inches and the high pressure 10¼x30 inches. Between them is placed a Sergeant vertical inter-cooler shown in section in Fig 2. This effectually removes the heat resulting from compression in the first cylinder and at the same time acts as a receiver or reservoir from which the high pressure cylinder draws. The low pressure cylinder has a novel and satisfactory form of inlet and discharge valve devised by H. S. Sergeant, the engineer of the company. This is a type of mechanical valve, which avoids the difficulties inherent with air compressor valves which have rigid rod connections, and it depends upon compressed air for its operation. A perfect adjustment can be obtained and cards taken from the cylinder are as regular as those obtained from a well-adjusted Corliss Steam Cylinder. The high pressure steam cylinder is provided with the Sergeant system of piston inlet valve (Fig. 3). In this type there is a high volumetric efficiency, owing to the remarkably small clearance volume necessary, the large valve openings and the rapid opening and closing of valves resulting from the peculiar construction of the valves themselves.

From Fig. 3 it will be seen that the piston is hollow, and has a hollow extension at the back end which passes out through a suitable stuffing box at the head of the cylinder. The piston, it will be seen, has in either face a circular slot, concentric with the piston rod. These slots are closed by a ring

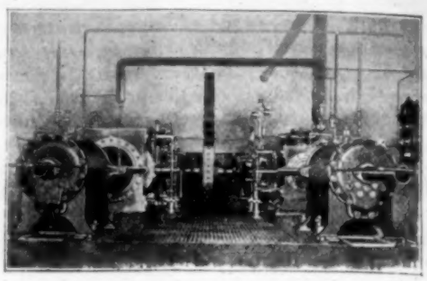


FIG. 1.— INGERSOLL SERGEANT AIR COMPRESSOR OF HORIZONTAL CROSS COMPOUND CORLISS TYPE.

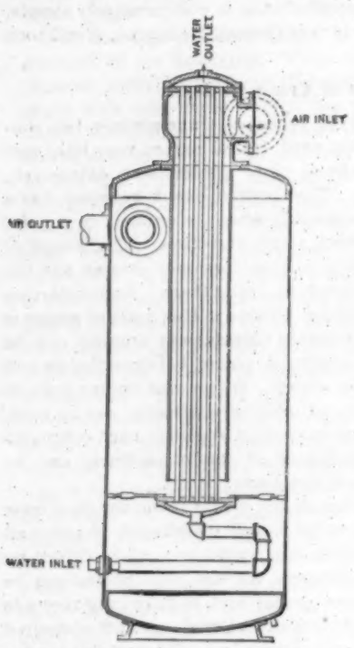


FIG. 2.— VERTICAL INTER-COOLER.

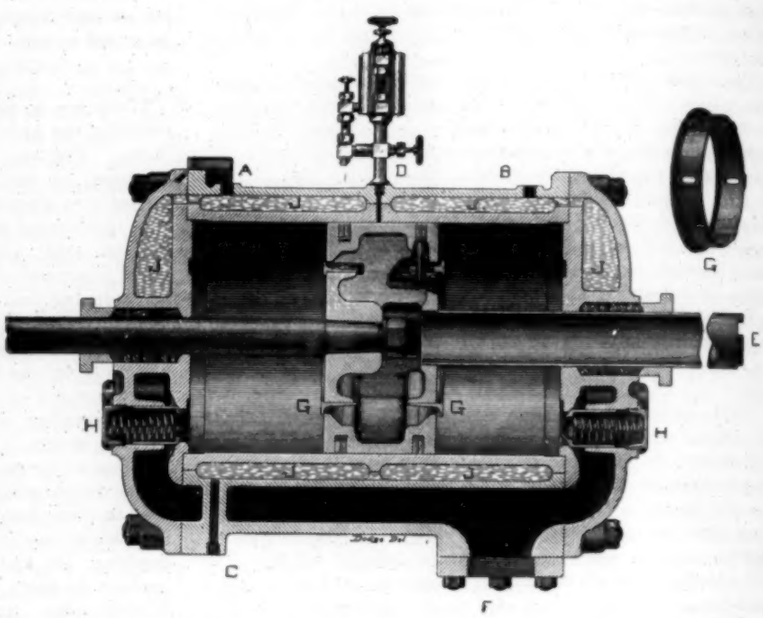


FIG. 3 — PISTON INLET AIR CYLINDER, SHOWING SERGEANT VALVE.

which, in a cross section, resembles a letter "T." No springs are needed to open or close these valves, as the inertia resulting from the movement of the piston throws them open or closed at the proper moment. It will be seen that this form of valve admits of a remarkably small clearance. In addition the constant inrush of cold air always passing in one direction helps to prevent excessive heating of the piston, while the water-jacketed cylinder and heads hold their temperature down to a low point. Both compressors discharge into a receiver which resembles the inter-cooler already described. This again reduces the temperature of the air to that of running water, and as a result, precipitates nearly all of the moisture contained in the air. From this reservoir a 4 inch pipe line is run straight away for over 900 feet to the Palace of Civil Engineering and Transportation. The air supplied by this line runs two Baldwin locomotives the New York Air Brake Co.'s exhibit, that of the Westinghouse Brake Co., Westinghouse signal system, the Standard signal system and other exhibits. A second and smaller line runs the entire length of the Machinery Annex Building, which taps off to the Q. & C. Co., the Standard Pneumatic Tool Co., the Chicago Pneumatic Tool Co., the Jeffrey Mfg. Co., the Ball Engine Co., and the Bullock Diamond Drill Co. Both compressors take steam at from 100 to 120 lbs. and furnish air at from 100 to 105 lbs., the two machines having a volume of about 1 000 cubic feet of free air per minute.

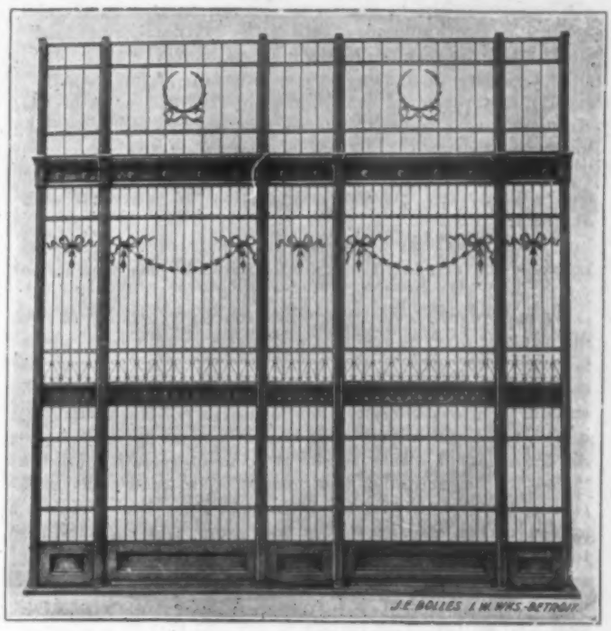
Among the mining machinery exhibited by the company is a large track channeler, intended for cutting a long, narrow, vertical slot in rock of any sort. Thirty-five of these were used on the Chicago Drainage Canal, where for miles they cut vertically through hard or uncertain rock to a depth of from 24 to 36 feet in three steps of 12 feet each. This machine consists of a fair sized vertical tubular boiler mounted on a heavy frame in turn supported by four flanged wheels which run on a track made in sections. At one side and supported on a substantial bracket are the cylinder guide, valves and controlling mechanism. Steam passes over from the boiler through flexible connections to the cylinder and causes the piston to reciprocate rapidly raising and driving down the cutting bars which are clamped to the guide chuck on the end of the piston rod. Machines of this type have cut as much as 475 square feet in 10 hours although the average on large work is from 160 to 175 square feet for the same time. Another machine shown is intended for quarries and places where the output would not warrant the expense of the large machine just described. It is called the bar channeler. It consists of a frame mounted on four adjustable legs. This frame has two long cylindrical slides, on which are mounted a carriage holding a powerful air or steam drill and a small engine which feeds the carriage back and forth along the frame. Of its standard rock drills the company have several of small and medium sizes set up for operation. These drills have a cylinder mounted in a guide frame and provided with a screw, which is used in operation to advance the cylinder as the drill cuts the rock. In the cylinder is a piston which forms part of the piston rod and chuck or device for holding the bit or cutting tool. There is also a special cylindrical slide valve which admits air to one or the other ends of the cylinder at the proper instant, and this causes the piston rod and chuck holding the drill bit to reciprocate rapidly. The drills are mounted on the Sergeant universal tripod. The company yearly produces over 2 500 of these drills of different sizes and it has already sold over 30 000 drills of all sorts. A pneumatic coal cutter, of which the company is turning out about 1,000 each year, and a type, which on this side of the water is a novelty, consists of a substantial cylinder mounted on wheel and provided with two handles, is also shown.

THE strike at the American Iron & Steel Mfg. Co. plant at Lebanon, Pa., has been settled. The men started to work in a body on Monday Sept. 24th. The new wages are on a $3 basis for puddling.

The new ship building plant for the Risdon Iron Works at San Francisco., Cal., will be built by the American Bridge Co., of New York, and will consist of a boiler shop, machine shop and foundry, all of the latest design and most modern description.

ELEVATOR GRILLE WORK.

The illustration herewith is taken from a photograph of the elevator fronts recently placed upon eight floors in the Hotel Cadillac, Detroit, by the J. E. Bolles Iron & Wire Works, of



that city. The work is highly finished, being polished steel electro-plated. Messrs. John Scott & Co., Detroit, are the architects. The grille work for this contract is pronounced by experts to be of the finest in that line.

THE report that there has been a cut made in the wages of employees of the Deering Harvester Co , of Chicago, is denied by officers of the company. The usual fall readjustment of the scale on piece work has been made, but in no case do the employes suffer as a result of any changes made. The general advance in wages made a year ago is still in force, and the company has no intention of reducing wages from the scale in force during last year. General Superintendent B. A Kennedy of the company says that every man in its employ is receiving more wages than he did one year ago or four years ago. Times are now better with the company, and consequently with its employes. The volume of business is greater than it was a year ago. It is stated that the company has at present not a single employe who does not receive at least $1.50 a day.

A SELLING arrangement has been made among the Grant Ball Co., Cleveland, the Cleveland Ball & Screw Co., the Steel Ball Co., Chicago, and the Excelsior Machine Co., Cleveland. Their product is now handled in common by a company known as the Central Distributing Co., 302 Mooney-Brisbane Bldg., Buffalo. An advance in price has been made, averaging some 20 or 25 per cent, though it is much more than that on certain sizes. The American Bicycle Co. is not a direct participant in the arrangement, but is said to be acting in harmony with the selling combination in the advance of prices.

H. M. MYERS & Co , of Beaver Falls, Pa., shovel manufacturers, have decided to add another rolling mill to their plant. Other additions and improvements will be made to increase the capacity of the plant to 450 dozen finished shovels a week.

THE Edgar Thomson steel works at Braddock will shut down Oct 20 for two weeks for the purpose of building extensions to the finishing mills in the rail department.

THE Sharon Steel Hoop Co., Sharon, Pa., has awarded the contract of erecting four compound engines, with a capacity of 600 h. p., to William Tod & Co., Youngstown, O.

CHEMISTRY AND PHYSICS OF CAST IRON.

Valuable data and opinions are brought out in the written discussion of the paper read by Paul Kreuzpointner, of Altoona, Pa., before the Franklin Institute on "Riddles Wrought in Iron and Steel." The contributors are some of the best authorities in the country on the metallurgy of steel and iron. From advance sheets of the Journal of the Franklin Institute we take the following installment:

Prof. Henry M. Howe (Correspondence):—After considering Mr. Outerbridge's contribution to the discussion of Mr. Kreuzpointner's paper, I should like his answers to the following inquiries:

1. What composition do you think gives the strongest cast iron? What the highest combination of strength with ductility?

2. How does the following statement of the relations between the composition and properties of cast iron strike you?

We may regard every graphitic iron as consisting of two distinct parts: (1) its graphite, and (2) its metallic part, which is everything except the graphite. Its metallic part is essentially steel or white cast iron, according to its combined carbon. Hence it consists essentially of ferrite and cementite, intermixed as far as they go in the ratio of 7:1 to form pearlite, the excess of either ferrite or cementite existing in the "free" or "structurally free" state. We know that steel reaches the greatest tenacity with about 1 per cent of carbon; as the carbon departs either way from this quantity, the tenacity diminishes. If we apply this to cast iron, then the metallic part reaches its greatest strength with 1 per cent of carbon, and all carbon in the metallic part in excess of 1 per cent, i.e., all combined carbon in the cast iron as a whole in excess of 1 per cent, is a source of weakness. It is also a source of brittleness and hardness.

All graphite causes weakness and probably brittleness. It is a foreign body, simply breaking up the continuity of the iron, and, itself weak, it must weaken the iron. In short, all carbon in excess of 1 per cent, whether combined or graphitic, weakens the metal. By varying the silicon and manganese, the pouring temperature and the rapidity of cooling, we can vary the distribution of the carbon between these two states, and thus minimize its harm; we can for every given percentage of total carbon distribute the carbon between these two states so as to minimize its harm; but the smaller the excess of total carbon over 1 per cent, the less is the harm which we have to minimize, and consequently the less the minimum harm.

If I am right, then the less the total carbon (provided it be not under 1 per cent), the stronger is it possible to make the cast iron by suitable adjustment of the carbon between the graphitic and combined states. We may expect that the same is true of ductility; all combined carbon must lessen ductility; we should expect graphite to lessen ductility, because it is a foreign body breaking up continuity; but this case is not so clear, for the reason which causes the leaves of a pamphlet to be more flexible as a whole than a sheet of pasteboard of like total thickness.

In this view the merit of the air furnace is that it effectively lessens the carbon of cast iron; the cupola does this to a much smaller extent, because the molten iron has an excellent opportunity to recover carbon in the bottom of the furnace. In this view the capital defect of the iron blast furnace, as an instrument for making foundry cast iron, is that it nearly saturates the iron with carbon, or at least gives it far more carbon than is consistent with the greatest strength, or the greatest combination of strength with ductility. It is hard to see how this fault is to be remedied within the furnace itself, since the desulphurizing action of the furnace, which cannot be dispensed with, is apparently part of the carburizing action. Both apparently take place in the crucible of the furnace, and both depend upon the same condition, viz., that the bath of molten iron in the crucible is penetrated by a solid column of incandescent coke, with the carbon of which the molten iron rapidly saturates itself, nearly or fully. This same carbon removes the sulphur from the iron, apparently, by the reaction

$$FeS + CaO + C = Fe + CaS + CO.$$

So, too, the capital defect of the cupola furnace as an instrument for making strong castings is that the molten iron in like manner greedily absorbs carbon from the fuel over which it runs at the bottom of the furnace; so that, no matter how little carbon the charge contains initially, as it issues from the cupola it seems inevitably over-rich in carbon. In these very hastily written remarks, for brevity I leave out of account variations in the condition of the combined carbon, between the states of martensite and cementite, the difficulties of casting metal of special composition, etc, confining myself strictly to the points here raised.

A. E. Outerbridge:—I beg to answer Prof. Howe's questions as follows:

A. 1. (*a*) The first query is too general to admit of a definite answer. The "strongest iron" for a casting of, let us say, 1,000 pounds weight and 4-inch section in its thickest part, would not be the strongest iron for a casting of say 50,000 pounds weight and correspondingly heavy section. Conversely, the strongest iron for the larger casting would not be the strongest iron for the smaller one.

A. 1. (*b*) Cold-blast charcoal iron combines the highest combination of strength with ductility.

A. 2. Prof. Howe's statement of "the relations between the composition and properties of cast iron" strikes me as ingenious but fallacious. Reasoning by analogy is (like circumstantial evidence) apt to be misleading, unless all the facts are known. This is especially the case when we attempt to compare an exceedingly complex alloy, like cast iron, with a more homogeneous metal like steel.

Even when we confine our analogies to steel itself we may go astray. For example: It was formerly thought that manganese, except in very small quantity, was deleterious to the quality of steel. Hadfield demolished this old belief by his brilliant investigations, producing a whole series of high-manganese steels incorporating at least ten times the quantity of manganese formerly thought to be permissible (or even possible) in steel, creating a new metal having extraordinary toughness and hardness, qualities usually regarded as more or less antagonistic.

Chemical science teaches us that two or more elements may unite together in several different proportions to form definite compounds (e.g., $FeO.Fe_2O_3$, etc.). We cannot say, therefore, that because "steel reaches the greatest tenacity with about 1 per cent of carbon . . . . all carbon in excess of 1 per cent, whether combined or graphitic, weakens the metal." All our knowledge of cast iron disproves this assertion. The strongest and most ductile pig iron is made with charcoal fuel and cold blast. This strong iron is comparatively rich in carbon, both combined and graphitic, and contains smaller percentages of silicon, sulphur and phosphorus than pig iron made with coke in modern hot-blast furnaces. Combined carbon in cast iron causes brittleness only when present in such large proportion that the fracture shows a mottled or white crystalline structure. In smaller proportion it gives strength to pig iron. The best hot-blast coke iron is a weaker and more brittle metal than the best cold-blast charcoal iron.

I differ entirely with Prof. Howe in the concluding sentences of his statement regarding the influences of carbon in cast iron. I also differ with him as to the reason why air-furnace iron is superior to iron melted in a cupola. I attribute the superiority of air-furnace iron to quite another cause, viz., the avoidance of blowing air through the molten iron and consequent avoidance of iron oxide in the molten metal. I am also compelled to differ with Prof. Howe regarding his assertion that "the capital defect of the iron blast furnace as an instrument for making foundry cast iron is that it nearly saturates the iron with carbon, or at least gives it far more carbon than is consistent with the greatest strength, or the greatest combination of strength with ductility." I believe that the strongest and most ductile cast iron is that which contains a maximum of carbon (about one-half combined and one-half graphitic) and a minimum of all other elements except iron.

Wm. R. Webster:—I desire to thank Mr. Outerbridge for his complete answers to my questions on cast iron, in his first paper, but I do not agree with his conclusions from the tests he refers to on annealed test bars of cast iron. These bars give more deflection after being annealed than before, and, as he has already stated, their breaking strength was less. I

think he will also agree that this material, in its annealed condition, will withstand shock better than before annealing. He has made out a very good case, showing the similarity between annealed cast iron and annealed steel, for in steel, when it is properly annealed, we have a reduction in strength, an increase in elongation, and also an increase in reduction of area. The material is much better fitted to withstand shock.

The other point, as showing the difference between cast iron and steel, in that the size of the grain of the cast iron depends on the mass of metal in the castings of iron, and that this difference in the size of the grain does not take place in steel, I do not agree with either. The difference does exist in steel, but not to such an extent as in the cast iron, and, as a general thing, in steel the castings are annealed, and this breaks up the large grain and produces the fine structure so much desired. Sir Henry Bessemer, some years ago, by slowly cooling a mass of molten steel, produced a very large grain in the metal, and, I think, taking everything into consideration, Mr. Outerbridge will have to modify his conclusions in both of the above cases.

I am pleased to note that the Association of American Foundrymen are now agitating the question of having our trade schools instruct the young men in chemistry pertaining to cupola practice, and also that Mr. Outerbridge is one of the members of their committee to carry out this work. I take this to indicate that the foundrymen will, from this time on, give freely what information they have on the subject that they propose to have taken up by the young men at our trade schools. If they do not do this, they will, of course, make a dismal failure. We all know that a few years ago our foundrymen were inclined to get all they could from their competitors, but to give nothing in return, treating all matters pertaining to their business as trade secrets; but, as I said before, the indications now are that they are going to take a different course from this time on.

I know of no better channel to instruct our young men than the Franklin Institute, and with this in view, I am going to ask Mr. Outerbridge some leading questions in regard to the foundry chemistry of today. Before doing so, I would like to state that I understand, of course, the difficulty of properly interpreting the results of our tests on cast iron, for, in the first place, if we take tension tests and reduce all the results to pounds per square inch, the results depend very much on the size of the casting from which the test-piece has been prepared and location from which it was cut, as Mr. Outerbridge has explained in his previous remarks. On the other hand, if we take transverse tests for our records, we will find all sorts of bars in use; for instance, 1-inch square bars held on supports 12 inches apart and 24 inches apart, and 1-inch by 2-inch bars placed on the side and placed on edge; supports, 24 inches apart; then we have the hexagonal bar, used by Mr. Whitney, which he considers has special merits for their class of work. The records of all these transverse tests are generally given in merely the center-breaking load, and it is not an easy matter to compare one with the other without doing some figuring. I also understand that even after we adopt any particular size of test bar and have our records of tests in shape, we cannot tell directly from the results what the character of the metal will be in a large casting, a medium casting or a small casting; we must estimate from the results of the tests on a 1-inch square bar; for instance, as to what the results will be in the different sized castings.

I would now like to ask Mr. Outerbridge if in his experience, knowing the chemical composition of a series of 1 inch square test bars, made under the usual conditions of practice for one grade of metal, he can, from the chemistry, tell what the breaking load would be for these bars.

(2) If, having the breaking load of these bars, the chemical composition and the deflection of the bars, he can estimate closely what the results of such metal would be in large castings, small castings and medium-sized castings.

(3) In making up the mixtures for the cupola, do you depend at all upon the fracture of the pig iron used, or do you treat the whole matter as just so much iron, carbon, phosphorus, sulphur, etc., irrespective of what the fracture of the metal may show?

(4) How closely can you estimate, from the composition of the mixture charged in the cupola, what the composition will be of the metal tapped from the cupola; in other words, what changes will take place in the melting of the iron?

(5) Can you so arrange your cupola mixtures as to produce a casting of a given chemical composition that you aim at to start with?

(6) If you can carry on your work, as indicated above, I would like to ask if you can estimate the strength of your test bars from the chemical composition of your charge, making allowances, of course, for the changes that occur in melting the metal.

(7) As a final question in this line, I would like to ask what elements you use in estimating the strength of your test bars, and the general method of doing this work; that is, the amounts per unit for the elements that you consider, and how these figures are modified, owing to the relation of one element to the others.

I think the above information would make a very fair starting point for our young men, and also for a good many of the older ones here present. I do not mean to impose on Mr. Outerbridge's good nature too much, or ask him to give away any of their trade secrets, but if the foundrymen are going to instruct the young men, they must give them the best information they have on these subjects, and I believe that in the end all would be gainers by doing so.

In 1895 I gave a proposed scheme for the study of the physics of casting to the American Institute of Mining Engineers, and knowing that there has been considerable advance in the process since that time, I would ask Mr. Outerbridge if he would be kind enough to bring these suggested lines for discussion and investigation up to date. In my list of questions to Mr. Outerbridge, I omitted the following: What is the best check test you know of, that can be made quickly before pouring the metal, that will show if it is suitable for the castings for which it is intended? In this I refer to some simple test that will show the physical character of the metal, similar to the ladle test used in melting steel in the open-hearth furnace. In steel there is always more or less trouble from the oxide of iron. This also gives trouble in cast iron, and I would like to ask, what is the best method of getting rid of the oxide of iron in cast iron, and how long has it been in use?

Postponed Engine and Boiler Orders.

A Chicago letter to the *American Machinist* refers to the held up business in power equipment:

"For the shop the relative demand for power just now is slow. Some business is being closed week by week, but the generality of the trade that engine and boiler-makers are now receiving, comes from other departments of activity. As a rule, boiler-makers are crowded with work, and instances are reported here where desirable business has been refused because of insufficient producing capacity. Engine makers are likewise well filled with orders. There have been almost innumerable 'jobs' which have 'died' this year. One engine representative here has on his desk a large package of carefully printed cards, each of which represents one of these 'deaths.' Each inquiry, when first presented to the engine builders had every promise of survival. The local strikes and other causes contributed to the excessive mortality of these projects and the trade is not without hope of many resuscitations, when another season dawns. For small boilers and engines, three months are now the common period of delivery, which forces shipment into the winter, thus making trade naturally quiet just now."

The Railroads and the New Price of Rails.

Commenting on the action of the steel rail manufacturers in fixing the price of rails at $26, the *Railroad Gazette* says: "Based on the past year's record, it is probably safe to assume that this price will hold good during the coming year. There seems to be no doubt that this will result in placing large orders, for it is doubtless true that orders have been held for some time in expectation of lower prices. Although $26 is probably not as low a price as the railroad companies would wish to buy rails for, still at this price they can have the satisfaction of knowing that it is $5 a ton less than English railroad companies pay for their rails, and about $6 a ton less than Continental companies pay. It is doubtless a fact that the United States is now the cheapest rail market in the world."

INDUSTRIAL SUMMARY.

[If you are in need of machinery of any description, please notify *The Iron Trade Review*, and we will put you in communication with our advertisers at once.]

New Buyers in the Market, and Some of Their Wants:—

S. Y. Hyde and A. Hirshheimer, president of the La Crosse Plow Co., are prominent in a new enterprise for La Crosse, Wis.—the manufacture of elevator buckets and tin packages for meat products. The old G. H. Pierce sash and door factory will be used.

The Department of Public Works, Pittsburg, is advertising for bids for two engines for the Brilliant pumping station. They will be compound, condensing, high duty engines of 12 000,000 gallons daily capacity. The lowest bid on previous advertising was $300,000 for engines of 15,000,000 gallons capacity. The first bids were rejected as being too high.

The boiler, engine, shafting, belting, dynamo, lathes, planers, etc., will be contracted for by R. Hesterberg, 214 West Second St., Cincinnati, for his plant. Brass goods will be manufactured. The building contracts have been let.

Biddle Mfg. Co., Knoxville, Tenn., will buy a 200-light, 110 volt dynamo, shafting, pulleys, hangers, 100-h. p. boiler, 50 or 60-h. p. automatic engine, etc.

At the United States Engineer Office, 166 Granby St., Norfolk, Va., sealed proposals for furnishing and delivering structural steel and iron castings at Fort Monroe, Va, will be received until 12 o'clock M., Oct. 18, 1900.

The Kokomo Brass & Iron Co. is being formed at Kokomo, Ind., with a capital stock of $100,000, to operate a brass and iron foundry. The company has purchased the plant of the Gruschow Mfg. Co., of Kokomo, and will enlarge it considerably. The brass plant of the company will occupy a two-story brick building, 50 x 80 feet in size, and will have a capacity of about 2,000 car brasses a day. The iron foundry will have a capacity of about 15 tons of castings a day, and will occupy a wooden building 131 x 40 feet in size. It will be equipped with a Whiting cupola and other modern appliances. The officers of the company are E. T. Hitchcock, of Chicago, president; T. J. Nerny, secretary and treasurer, and F. C. Peck, vice-president. The output of the company will be almost entirely railroad work, including cars brasses and brake shoes.

The capital stock of the Canada Iron Furnace Co., Ltd., of Toronto, Can., has been increased from $300,000 to $1,000,000.

The Unique Iron Co., Cedar Rapids, Mich, has been incorporated for a general iron manufacturing business. Capital, $10,000. Incorporators: F. A. Stuart and M. E. Grubbs.

The American Steel Tool Co, of Chicago, was incorporated last week. Capital, $10,000. Incorporators: R. O. Evans, E. J. Pratt and B. M. Frees. The new concern will manufacture tools.

The Empire Covering Co., Brooklyn, N. Y., has been incorporated with a capital stock of $5,000. The concern will manufacture asbestos pipe and boiler coverings. Incorporators: G. H. Dudley, W. J. Palmer and H. W. West.

The Alva Rolling Mill Co., Alva, O. T., was incorporated with a capital stock of $25,000. Officers are G. D. Curton, president; W. A. Franks, vice-president and H. G. Hackney, secretary and treasurer.

The Dover Mfg. Co., Canal Dover, O., has been organized with a capital stock of $100,000. The plant of the Sad Iron Co., Edgerton, Wis., has been absorbed by the new company and the machinery of the plant will be removed to Canal Dover, O.

The certificate of incorporation of the National Smelting Co., St. Louis, Mo., was filed at Dover, Del., last week. The capital stock of the new concern is $500,000.

The Universal Machine Co. was granted a New Jersey charter last week, with a capital of $50,000. The incorporators are: C. F. Mathewson, J. F. Eagle, E. J. Patterson and Harmon & Mathewson, attorneys.

Fires and Accidents:—

The spiegel furnace of the New Jersey Zinc & Iron Co., South Bethlehem, Pa., was partly destroyed last week by the furnace breaking out near the tap hole. The loss is estimated at $8,000. Repairs will be made immediately.

The Iron Mountain railroad shops, located at Baring Cross, Ark., were totally destroyed by fire last week. They were the main shops of the Iron Mountain system. Loss $250,000.

Fire destroyed a portion of the Palmer Iron Works at Muncie, Ind. The loss is $5,000, insured.

The machine shop and foundry operated by Pattin Bros., Marietta, O., was partially destroyed by fire recently. Loss, $15,000, partly covered by insurance.

The Rockdale, Ill., plant of the American Steel & Wire Co. was flooded last week by the collapsing of an 80,000 gallon tank on the Rock Island road, near the plant.

New Construction:—

The Akron Electrical Mfg. Co., of Akron, O., has nearly completed a machine shop addition 50 x 45 feet.

It is reported that the plant of the Kelly Ax Co., which was burned at Alexandria, Ind., Aug. 19, will be rebuilt at once.

Additions are to be made at the crane plant of the Philadelphia Engineering Works, controlled by the Niles-Bement-Pond Co. Two fireproof structures will be erected, one an extension 40 x 66 feet and the other a new building 200 x 100 feet, and three boilers will be set. The work will be done by the Fort Pitt Bridge Works, Pittsburg, Pa.

The Buffalo, Rochester & Pittsburg Railroad is building locomotive repair shops at Dubois, Pa., spending $350,000.

The American Ax & Tool Works at Glassport, Pa., will be greatly enlarged this fall. The company has purchased ground 150 x 700 feet adjoining its present plant. The additional works will employ 500 men.

The Risdon Iron Works which purchased recently the property of the old Pacific Rolling Mill Co., San Francisco, adjoining the Union Iron Works, announce that a new dry dock will be built and several new buildings, including the following: Machine shop, 308 x 100 feet, total lift over main floor, 45 feet; boiler shop, 140 x 180 feet, lift over main floor, 40 feet; machine and ship blacksmith shop, 300 x 60 feet; foundry, 177 x 160 feet; ship joiner shop, 140 x 81 feet. The machine shop will have a 50 ton, a 20-ton, a 15-ton and a 10 ton electric traveling crane; the boiler shop with a 60-ton, 20 ton and 10-ton crane, and the foundry with a 30-ton and a 20-ton crane—all the above equipped with 5-ton auxiliary hoists. The American Bridge Co. has the contract for erecting the machine shop, boiler shop and foundry.

The New England Structural Co., Boston, has been awarded the contract for the steel frame work for the engine and boiler house for the United States Steel Co., at Everett, Mass. The contract calls for completion in six weeks. The main building of the steel casting company's plant is 120 x 200 feet, and is nearly up. Two 15-ton open-hearth furnaces are being built.

The Chattanooga Steel Roofing Co., Chattanooga, Tenn, will erect a foundry in connection with its present plant, 100x150 feet. A warehouse will also be built, 50x115 feet. The foundry will be equipped with the latest labor-saving appliances.

The George Clarke Engine & Boiler Co., Kalamazoo, Mich., has commenced the erection of an addition to its plant, 60x100 feet.

The plant of the Kingsford Boiler Co., Oswego, N. Y., recently destroyed by fire is to be rebuilt. The new structure will be 260 feet long and 120 feet wide. The building will be of steel construction and will be erected by the American Bridge Co.

The Janesville Machine Co., Aurora, Ill., is erecting a warehouse, 40x66 feet.

The American Injector Co., of Detroit, will erect a three-story brick addition, 122x60 feet.

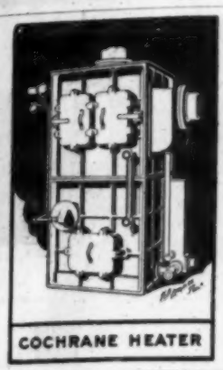
Plans have been completed for the new machine shop to be built for the Baizley Iron Works, Philadelphia, Pa.

The Russel Machine Co. will erect a steel building, 75x120 feet at 28th St. and the Allegheny Valley railroad, Pittsburg, to be used as a repair shop.

The Pittsburg District:—

The Damascus Steel & Forge Co., located at Carnegie, Pa., was sold under the hammer last week. The forced sale was made upon a judgment secured against the company some time ago.

A charter was granted at Harrisburg last week to James McNeil Bros. Co., of Pittsburg. Capital, $150,000. The incorporators are Thomas McNeil, Sr., Thomas McNeil, Jr.,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Not one so well fills the requirements as the Cochrane Oil Separators, one of which is attached to and forms part of every Cochrane Heater. There are in the neighborhood of 2,500 of these self-cleaning Cochrane Oil Separators in present use, ranging in size from 1 in. to 36-in. inclusive, and they are used on heaters of all sizes from the smallest to those of 10,000 H. P. Each Cochrane Heater is guaranteed, the conditions being anything like normal, to give complete protection from oil, taking the exhaust from any kind of pumps, or non-condensing engines.

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Thomas McNeil, James Martin and James McNeil. The new company will succeed James McNeil & Bro., which has been operating a boiler works at 54th St. and Allegheny Valley railroad. The business of the new company will be conducted on the same lines as it has been by the company that goes out of existence.

The contract for furnishing the structural steel for the new Empire Theater to be erected in Pittsburg has been awarded to the Carnegie Steel Co. About 1,000 tons will be required.

It is reported that the American Steel & Wire Co. is negotiating for the purchase of additional land adjoining the Shoenberger plant in Pittsburg.

Notices have been posted in the axle department of the Pittsburg Forge & Iron Co., notifying the men of a proposed reduction in wages of from 2 to 4 cents an axle.

Furnace E in the Edgar Thomson group of blast furnaces of the Carnegie Steel Co. at Braddock, Pa., was blown out this week. It is to be rebuilt and will be made 25 feet higher than at present.

The blast furnaces of the National Steel Co and the Republic Iron & Steel Co., Sharon, Pa., were blown out this week. Extensive repairs will be made. They will resume operations in about two months.

The National Tube Co. has signed the Amalgamated Association scale for its Frankstown mill on Second Ave., Pittsburg.

The 14-inch and 16-inch skelp mills of the Republic Iron Works, located on the South Side and controlled by the National Tube Co., were placed in operation last week.

It is reported that J. C. Mercader, an engineer employed by the Carnegie Steel Co., is making experiments at the Edgar Thomson Steel Works with a process for manufacturing hollow steel shafting and car axles.

The Pressed Steel Car Co., Pittsburg, Pa., was awarded a contract by the Baltimore & Ohio railroad last week for the construction of 6,000 freight cars of a carrying capacity of 100,000 pounds each. Of these 4,000 will be gondolas and the remaining self-clearing hopper cars. This order without a doubt is the largest ever given for railway equipment and is by far the largest order ever booked by the Pressed Steel Car Co. The money value of the contracts of the past week, according to president Schoen is about $7,000,000. The steel required to complete the order will amount to about 100,000 tons. Besides the order mentioned the Pressed Steel Car Co. has received from the Union Pacific orders for 480 ballast cars of 100,000 pounds capacity and 300 hopper cars, an order for 300 cars for the Transvaal, South Africa, and 75 cars for the Davenport & Rock Island road.

Chicago District and Northwest:—

The Block Mfg. Co. has been incorporated at Chicago, with a capital stock of $130,000, to manufacture iron and steel. The incorporators are A. J. O'Donnell, Leon M. Groesbeck and H. Weil.

The Nordberg Mfg. Co., of Milwaukee, Wis., is about beginning the erection of the additions planned some time ago and heretofore mentioned. The new plant will be ready for complete operation by another year.

One of the largest electric cranes ever built has just been completed by the Pawling & Harnischfeger Co., of Milwaukee, Wis. It was built by that company for the Midvale Steel Co., of Philadelphia, and will be used in the armor plate department of the Midvale company. The crane has a capacity of 200 tons. The cost was $40,000, and it will take 16 flat cars to transport the crane to its destination.

The Sall Mountain Asbestos Co., Chicago, has recently taken a large order from one of the leading local electrical concerns, and this, with several other large orders the company has recently taken, from different parts of the country, is keeping it unusually busy at present. The company was incorporated about a year ago, and since then it has almost trebled its original capacity for turning out steam pipe and boiler covering.

It is stated that the Minneapolis Machinery Co. is building a two story brick machinery warehouse, 75x100 feet in size, at Fargo, N. D.

The Q. & C. Co., Chicago, has given a trust deed of its factory property, at Chicago Heights, to secure a loan of $100,000 for three years at 5 per cent.

Chas. H. Besly & Co., of 10 and 12 N. Canal St., Chicago, writes as follows of the condition of business: "Our general business is very good. We have made a number of large shipments to the North and Middle West of complete shop equipments, and are receiving many orders for small tools from the same sections. Many orders for Helmet oil, Bonanza cups and Helmet Babbitt are daily being received from Western mining districts. During the recent automobile exhibit at Washington Park the past week it was a daily occurrence

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Safety Water Column.
Steam Separator.
Exhaust Pipe Head.
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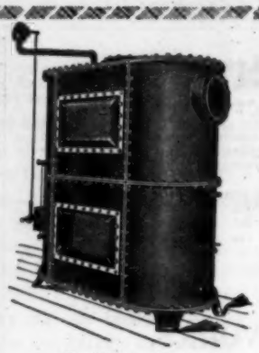

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FEED WATER HEATERS

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SINGLE, DUPLEX AND TRIPLEX.

AIR COMPRESSORS

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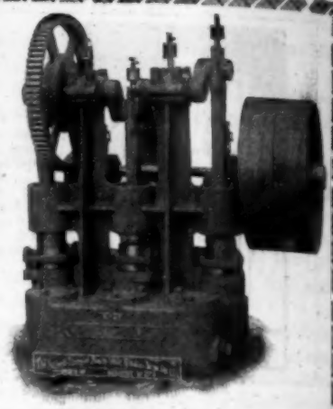

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for owners or representatives of various automobile manufacturers to call at our store and say, 'Give me a can of Helmet oil and some Bonanza oil cups for my machnie; I want to win that race this afternoon.' Our new catalogue is now ready for distribution and will be mailed free to any address upon application."

The Scientific Mfg. Co., having offices in the Rookery Bldg., Chicago, has leased the old plant of the Gray Electric Co. at Highland Park, Ill., and will occupy it as soon as its machinery is installed. The tract leased contains about eight acres, with a two-story and three-story factory building on it. Included in the lease were ten cottages which were occupied by employes of the electric company. The lease includes an option to purchase. The Scientific Mfg. Co. is a new concern recently formed for the manufacture of commercial decalcomanias. The use of this product for signs and lettering on wagons, implements, bicycles, pianos, pottery, glass, and in any place where permanent lettering or decoration is to be placed, has increased greatly in the past few years, but nearly all the decalcomanias used for these purpose have been imported heretofore. The Scientific Mfg. Co. has ordered presses and other necessary machinery for the manufacture of the product, and within a short time will be in position to turn out a large amount of work. It is already in position to take orders. A. M. Crane, formerly general sales agent of the Illinois Steel Co., and later assistant general manager of the American Steel & Wire Co., is president of the new company, and with J. A. Carey, secretary, will conduct its management.

The plant of the Siemens-Halske Co. at Grant Works, Chicago, has been shut down by orders of the General Electric Co., the owner of the Siemens-Halske Co. The plant has had a varied career. It was originally built by the Grant Locomotive Works, which later became insolvent. It was then purchased by the Siemens-Halske Co., which equipped it for the manufacture of electrical engines and appliances. In 1897 the Siemens-Halske Co. was absorbed by the Pennsylvania Iron Works, by an exchange of capital stock. In 1899 the Electric Vehicle Co. bought the capital stock of the Siemens-Halske Co. from the Pennsylvania Iron Works, and began using the plant for the manufacture of motors, etc. Last spring the capital stock of the Siemens-Halske Co. was again sold, this time to the General Electric Co. It was understood at the time of the purchase that the works would be shut down, and this has now been done, and the plant will be dismantled.

General Industrial Notes:—

The Akron Electrical Mfg. Co., of Akron, O., manufacturer of motors, dynamos and electrical supplies, has been reorganized and newly incorporated under West Virginia laws. Its stock has been increased from $100,000 to $200,000. New machinery to the amount of $10,000 has been installed and $8,000 worth in addition will soon be put in. The following officers have been elected: L. C. Miles, president; Will Christy, vice-president; E. E. Andrews, secretary and treasurer. The directors elected are L. C. Miles, Will Christy, E. E. Andrews, William Weaver, Dr. J. P. Boyd, W. H. Butler and S. H. Pitkin.

The Republic Iron & Steel Co. will make further important improvements in the Youngstown, O., district. The second blast furnace at Haselton which has been under consideration for some time is to be undertaken soon. New casting machines are to be installed at the Haselton, Hannah and Atlantic furnaces. A new finishing mill is to be built on the site of the old sheet mill at the Brown-Bonnell works. The No. 1 furnace at Haselton has been made practically a new one. When this and the Hannah and Atlantic stacks are all completed they will have an output of about 900 tons a day. This much and probably more will be required by the new steel plant. The company must also produce foundry and mill iron, and to be

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entirely independent in the matter of pig iron supply, the proposed No. 2 furnace at Haselton will be a necessity.

The Cherry Valley Iron Co., operating the Leetonia, O., furnace, has contracted with the Weimer Machine Co., of Lebanon, for a 90 x 60-inch blowing engine.

The Wilmarth & Morman Co. is moving its drill grinder plant from Kalamazoo to Grand Rapids, Mich.

It is rumored that C. E. Buek, of Chattanooga, Tenn., has leased and will blow in Trussville furnace.

The Talladega Furnace at Talladega, Ala., has shut down. It was put in blast early in the year.

The Norton Iron Works, of Ashland, Ky., have purchased and will operate the Kanawha Nail Works at Kanawha City, W. Va.

It is announced that Mr. Lucas retires from the firm of Lucas & Gliem, manufacturers of machine tools, etc., Philadelphia, and the business continues under the name of Frederick H. Gliem & Co. The active partners are F. H. Gliem, who will give his attention to the business end and electrical construction department, and Jacob E. Gombar, who will superintend the mechanical end. Mr. Gombar was some time back connected with the Newton Machine Tool Works, and for three years past with the Midvale Steel Co.

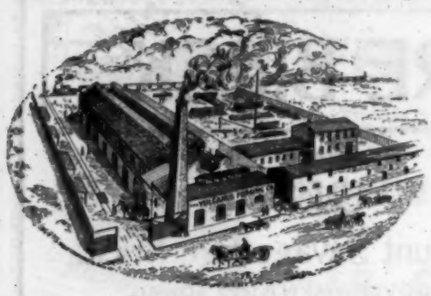
At the time of the opening of the new Bessemer plant of the Republic Iron & Steel Co. at Youngstown, last week, it was reported that a sheet bar mill would soon be erected in connection with the new plant just completed. An official of the company states, however, that there is no such plan.

The Lloyd-Booth Co., Youngstown, O., was last week awarded the contract for the erection of a new 26-inch billet mill which the Republic Iron & Steel Co. will erect at its Youngstown, O., plant. S. V. Huber, Pittsburg, Pa., designed the new mill. It will require about 500 tons of castings.

The Tudor Iron Works of the Republic Iron & Steel Co., located at East St. Louis, resumed operations last week after a suspension of several months.

As a result of the signing of the Amalgamated Association bar iron scale, the plant of the Republic Iron & Steel Co. at Sharon, Pa., and the plant of the American Steel Hoop Co., Greenville Pa., were placed in operation last week.

The Charlotte Steel & Iron Co., of New York, assigned last week. It was incorporated on Feb. 2, 1900, with a capital



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BOLTS & RIVETS,
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Having the best foundry and machine shop facilities, we solicit correspondence in this line. Promptness of delivery and work guaranteed.
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Regenerative Gas Furnaces and Water Seal Gas Producers.
Producer Gas under Tubular Boilers, saving 20 per cent in fuel. NO SMOKE.

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CATALOGUE SENT ON REQUEST.
PHOENIX HORSE SHOE CO., POUGHKEEPSIE, N. Y.—JOLIET, ILL.

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Victor Boiler and Structural Rivets
FINISH UNEXCELLED. QUALITY HIGHEST STANDARD.
GOVERNMENT WORK A SPECIALTY.

"13"
Within the month of July, 1900, we had orders upon our books for thirteen different blast furnace linings, crucibles, boshes and in-walls, going north, east, south and west. We believe this record to be unequalled and offer it as an advertisement of the fact that we make the best blast furnace and hot blast stove material made in the United States today.
KENTUCKY FIRE BRICK WORKS,
FIREBRICK, KY.

stock of $100,000, Wm. A. Mears, of Philadelphia, becoming president. It leased a blast furnace at Charlotte, N. Y., ten miles from Rochester, and began operation in April and shut down two months later. It was then stated that the Sheriff of Monroe County had attached a quantity of pig iron at the suit of the Old Sterling Iron Co. on a claim for $5,800. The assignment was caused by the decline in the price of pig iron.

Excursions to Chattanooga, Tenn., via Pennsylvania Lines.

October 7 and 8, for General Encampment of Spanish-American War Veterans, and Reunion of Society of Army of the Cumberland, excursion tickets will be sold to Chattanooga, Tenn., via Pennsylvania Lines; valid returning until Sunday, October 14.

C. T. & V.—B. & O. R. R.

The only line running through sleeping cars to Washington and Baltimore. Through fast train from Cleveland daily at 3.25 P. M. Through local sleeper from Cleveland to Chicago daily at 9:40 P. M. with Royal Blue dining car into Chicago 8:30 A. M. City Ticket Office, 241 Superior street, Depot foot South Water street.

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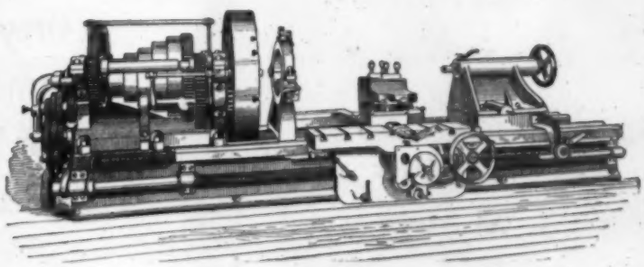

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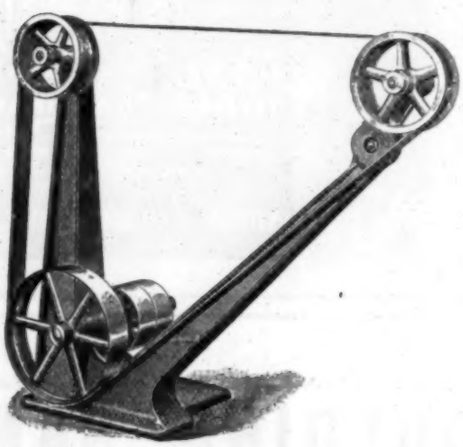

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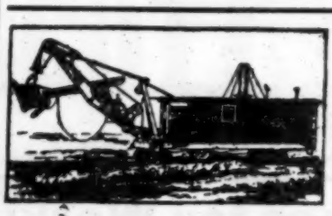

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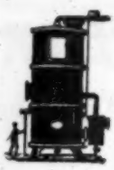

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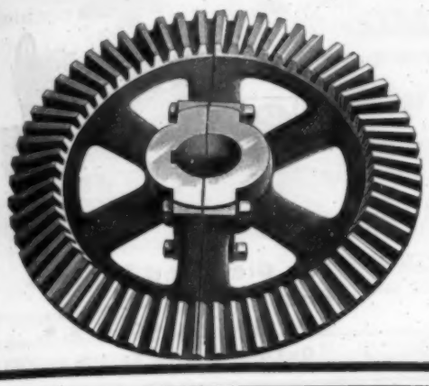

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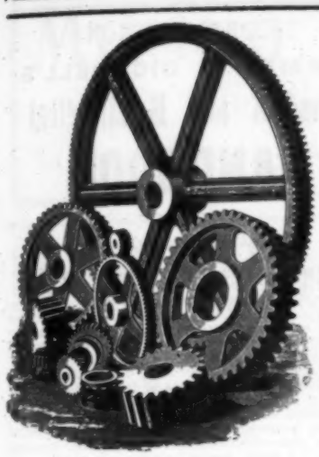

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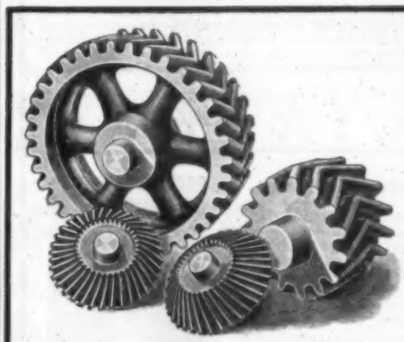

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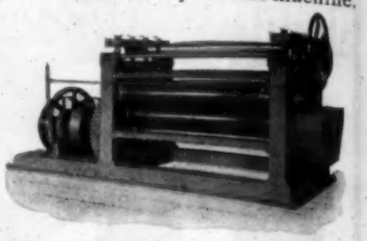

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In the preparation of the second edition of our Handbook, the general plan of the first edition has been followed, viz., to present in concise form such data and information as are useful to the chemist and metallurgist. Several tables of the first edition, which were of somewhat limited use, have been omitted, while more than one hundred pages of new matter have been added.

The methods for analysis of iron ore, iron and steel and for assaying have been given briefly, but perhaps as much in detail as is consistent with the general scope of the book. Several changes and additions to the Specific Gravity tables have been made by adoption of later and more accurate values.

In the notes on blast furnace practice have been outlined the more important theoretical and practical points, which, it is hoped, will be of some service to those interested in the manufacture of iron.

The hygrometric table gives the necessary information for determining the amount of moisture in air, a subject whose importance in metallurgical operations is being more fully recognized at present than heretofore. This table is new and is based on the most accurate data available at the present time.

The tables of weights and measures, United States and foreign, have been very much amplified, and the conversion tables for United States and metric weight and measures of the U. S. Coast and Geodetic Survey included, the latter being based on the legal standard for this country.

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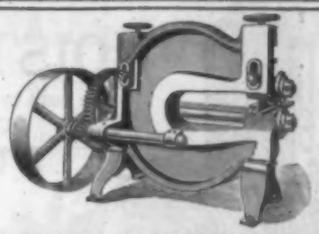

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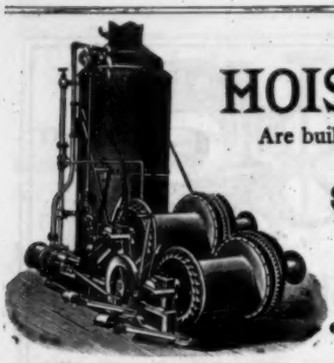

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From the circular of the Association, issued under date of Sept. 15 we take the following:

"In March last we presented to the American Iron Trade a descriptive list of the consolidations of iron and steel companies which had taken place in the United States since January 1, 1898, twenty-three in all. We now present to the trade a more complete list of iron and steel consolidations, embracing those organized since March as well as those previously described, *numbering thirty in all*, the information relating to each consolidated company being revised and verified down to August 15. We have confined the list of consolidations to those which embrace the ownership of blast furnaces, rolling mills, steel works, tinplate works, and auxiliary industries, including shipbuilding and bridgebuilding works. Only companies that have been consolidated since January 1, 1898, are described in this volume, which is a Supplement to the last edition of our Directory to the Iron and Steel Works of the United States. *A new edition of the Directory cannot be printed this year.*

"The present edition of the Supplement comprises 78 well printed pages and contains an authorized description of the organization of each of the thirty consolidations mentioned, giving its capitalization, list of officers, general office address and address in most instances of the district offices, and a list of properties owned or operated by it, with the names of previous owners of iron and steel works. The name and the character of every plant are fully stated. For detailed information concerning the plants mentioned and their products reference is given to the page or pages in the Directory in which they are fully described. Iron ore mines, coal mines, coke ovens, railroads, and lake vessels owned by the consolidated companies are also given in sufficient detail."

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In the edition for 1896 there was given for the first time a complete list of Malleable Iron Works in the United States, and to this new feature there are now added complete lists of the Rail Mills, Structural Mills, Steel Casting Works, Bolt, Nut and Rivet Works, Chain Works, Seamless Tube Works, and Riveted Pipe Works—all new features

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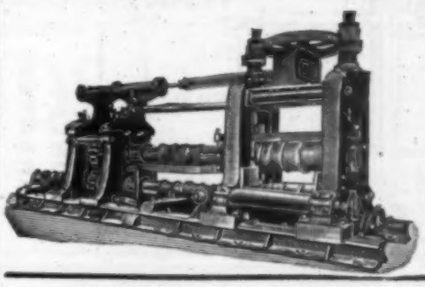

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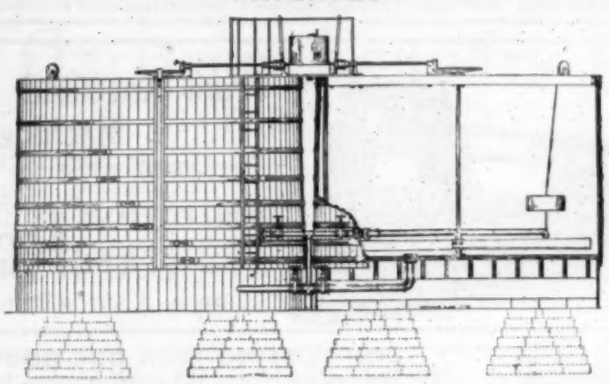

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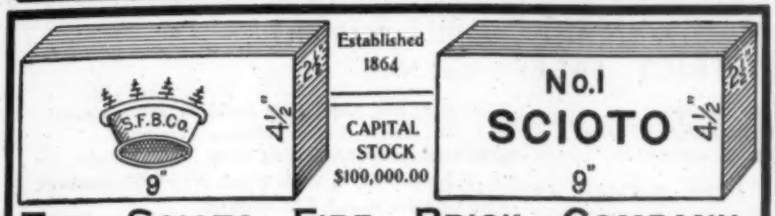

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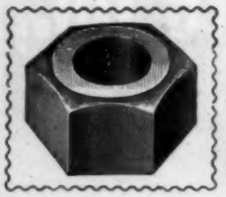

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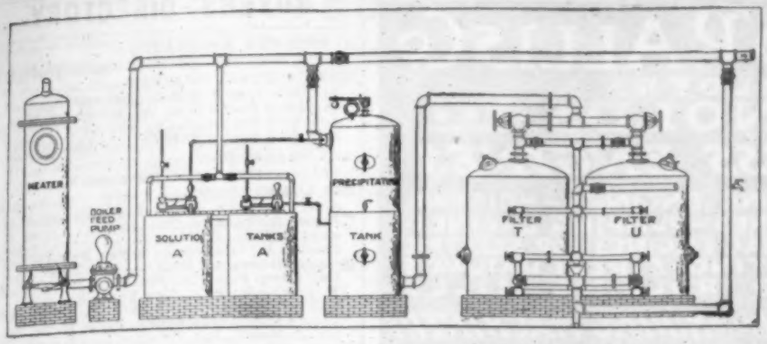

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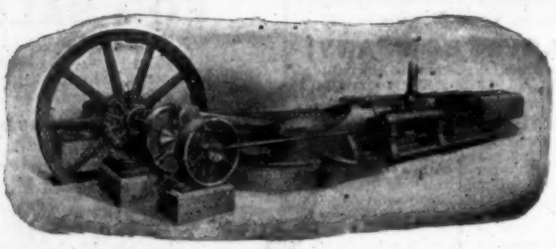

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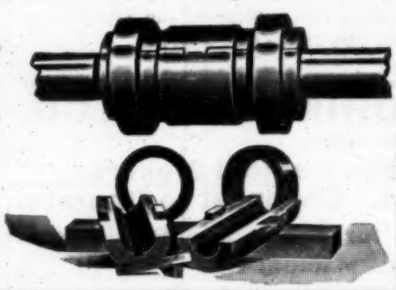

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CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

CARRYING TONGS—
Vulcan Mfg. Co., Pittsburg, Pa.

CASTINGS—
Seaman-Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O.
W. A. Jones Foundry Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Schuylkill Iron & Steel Co., Philadelphia, Pa.
The Aultman Co., Canton, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va.
Lorain Foundry Co., Lorain, O.
West Penn Foundry & Machine Co., Avonmore, Pa
Link Belt Machinery Co., Chicago, Ill.
Massillon Iron & Steel Co., Chicago. Ill.
Enterprise Mfg. Co., Columbiana, O.
E. R. Allen, Corning, N. Y.

CASTINGS (ALUMINUM)
J. J. Ryan & Co., Chicago, Ill.

CASTINGS (BRASS)—
J. J. Ryan & Co., Chicago, Ill.
Lorain Foundry Co Lorain. O.

CASTINGS (BRONZE)—
J. J. Ryan & Co., Chicago, Ill.
Lorain Foundry Co., Lorain, O.

CASTINGS (MALLEABLE)—
Acme Steel & Malleable Iron Works, Buffalo
Meadville Malleable Iron Co., Meadville, Pa.

CASTINGS (Steel)—
Bethlehem Steel Co., South Bethlehem, Pa.
Otis Steel Co., Cleveland, O.
Acme Steel & Malleable Iron Works, Buffalo, N. Y.

CEMENT—
Garden City Sand Co., Chicago, Ill.
Reed F. Blair & Co., Pittsburg, Pa.

CHAIN—
Standard Chain Co., Pittsburg, Pa.

CHAIN BELTING—
Heyl & Patterson, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
The Aultman Co., Canton, O.

CHANNELERS—
The Ingersoll-Sergeant Drill Co., New York.

CHANNELS—
American Steel Hoop Co., New York City.

CHEMISTS—
F. A. Emmerton, Cleveland, O.
O. Textor, Cleveland, O.
The R. W. Hunt & Co., Chicago, Ill.
Grasselli Chemical Co., Cleveland, O.
We Fu Go Co. Cincinnati, O.

CHILLED AND SAND ROLLS—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
Lorain Foundry Co., Lorain, O.
The Lloyd Booth Co., Youngstown, O.
WestPennFoundry & Machine Co., Avonmore, Pa
Frank-Kneeland Machine Co., Pittsburg, Pa.
A. Garrison Foundry Co., Pittsburg, Pa.

COAL CUTTERS—
The Ingersoll-Sergeant Drill Co., New York.
Jeffrey Mfg. Co., Columbus, O.
Link Belt Machinery Co., Chicago, Ill.

COAL SCREENS—
Hendrick Mfg. Co., Carbondale, Pa.
Rob't. Aitchinson Per. Metal Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Western Machinery & Supply Co., Chicago, Ill.

COAL AND COKE—
M. A. Hanna & Co., Cleveland, O.
Rogers, Brown & Co., Cincinnati, O
Jerome Keeley & Co., Philadelphia, Pa.
Reed F. Blair & Co., Pittsburg, Pa.
Pilling & Crane, Philadelphia, Pa.
Pickand, Brown & Co., Chicago, Ill.
H. C. Frick Coke Co., Pittsburg, Pa.
McKeefrey & Co., Leetonia, O.
Pickands, Mather & Co., Cleveland, O.
J. H. Hillman & Son, Pittsburg, Pa.
Cherry Valley Iron Co., Pittsburg, Pa.
Bessemer Coke Co., Pittsburg, Pa.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

COAL HANDLING MACHINERY—
A. Leschen & Sons Rope Co., St. Louis, Mo.

COAL MINING MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
Webster Camp & Lane Machine Co., Akron, O.
Link Belt Machinary Co., Chicago, Ill.
A. Leschen & Sons Rope Co., St. Louis, Mo.

COMPAROMETERS—
Vulcan Mfg. Co., Pittsburg, Pa.

COMPRESSION COUPLINGS—
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.

CONDENSERS—
Stilwell-Bierce & Smith-Valle Co., Dayton, O.

CONTRACTORS' SUPPLIES—
A. Leschen & Sons Rope Co., St. Louis, Mo.

CONVEYING MACHINERY—
A. Leschen & Sons Rope Co., St. Louis, Mo.

CONVEYORS—
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O.

COPPER GASKETS—
Drake Acetylene Apparatus Co., Cleveland, O.

CORRESPONDENCE SCHOOLS—
International Correspondence Schools, Scranton, Pa.

CORRUGATED IRON—
Berger Mfg. Co., Canton, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.
American Sheet Steel Co., New York City.

COTTON TIES—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.

CRANES—
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Northern Engineering Works, Detroit, Mich.
Wm. Tod & Co., Youngstown, O.
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.
Cleveland Crane & Car Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.
Atlas Machine Co., Pittsburg, Pa.

CRANES AND DERRICKS—
A. Leschen & Sons Rope Co., St. Louis, Mo.

CRANK PINS—
Bethlehem Steel Co., S. Bethlehem, Pa.

CUPOLAS—
Riter-Conley Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
The United Boiler Co., Girard, O.
Wm. B. Pollock Co., Youngstown, O.
Whiting Foundry Equipment Co., Harvey, Ill.

DIES—
Danielson Machine & Tool Co., Cleveland, O.
American Steel & Wire Co., Chicago, Ill.

DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
The Jeffrey Mfg Co., Columbus, O.
Thew Automatic Shovel Co., Lorain, O.

DRILL GRINDERS—
J. Wendell Cole Columbus, O.

DRILLING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

DRILL PRESSES—
Cleveland Punch & Shear Wks. Co., Cleveland, O.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co. Pittsburg, Pa.

DROP FORGINGS—
Wyman & Gordon, Worcester, Mass.
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Jas. H. Baker Mfg. Co., Pittsburg, Pa.
Frankford Steel & Forging Co., Philadelphia, Pa.
E. D. Clapp Mfg. Co., Auburn, N. Y.

DROP HAMMERS—
Cleveland Punch & Shear Wks. Co., Cleveland, O.

DROP PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
H. Konigslow & Bro., Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Bethlehem F'dry & Mach Co., Bethlehem, Pa.

DYNAMOS—
Jeffrey Mfg. Co., Columbus, O.

EAVE TROUGHS AND CONDUCTORS—
Berger Mfg. Co., Canton, O.

ELECTRICAL MACHINERY SUPPLIES—
A. Leschen & Sons Rope Co., , Louis, Mo.
Pelton Engineering Co., Cleveland, O.

ELECTRICAL WIRES AND CABLES—
American Steel & Wire Co., Chicago, Ill.

ELEVATING AND CONVEYING MACHINERY
Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill
Lidgerwood Mfg. Co., New York City.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster Camp & Lane Machine Co., Akron, O

EMERY AND CORUNDUM WHEELS—
C. H. Besley & Co., Chicago, Ill.
J. Wendell Cole, Columbus and Chicago.
Northampton Emery Wheel Co., Chicago, Ill.

EMERY WHEEL MACHINERY—
J. Wendell Cole, M.R., Columbus, O., or Chicago
C. H. Besly & Co., Chicago, Ill.
Northampton Emery Wheel Co., Chicago, Ill.

ENGINEERS AND CONTRACTORS—
Wellman-Seaver Engineering Co., Cleveland, O.
Walter Kennedy, Pittsburg, Pa.
Heyl & Patterson, Pittsburg, Pa.
Meehan Boiler & Construction Co. Lowellville,
E. E. Erickson, Pittsburg, Pa.
Riter-ConleyMfg. Co., Pittsburg
Julian Kennedy, Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
Alex Laughlin & Co., Pittsburg,
We Fu Go Co., Cincinnati, O.
James Bonar & Co., Pittsburg, Pa.
David Lamond, Pittsburg, Pa.

ENGINE PACKING—
Jenkins Bros., New York City.
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

ENGINEERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.
Wright Mfg. Co., Cleveland, O.
Drake Acetylene Apparatus Co., Cleveland, O.

ENGINE LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co. Pittsburg, Pa.

ENGINES (OIL)—
The Aultman Co., Canton, O.

ENGINES (STEAM)—
Wm. Tod & Co., Youngstown, O.
The Edward P. Allis Co., Milwaukee, Wis.
The Hooven, Owens & Rentschler Co., Hamilton, O.
The Aultman Co., Canton, O.
Geo. B. Sennett Co., Youngstown, Ohio.
Vulcan Iron Works, Wilkes-Barre, Pa.

FEED WATER HEATERS AND PURIFIERS—
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
We Fu Go Co., Cincinnati, O.
Stilwell-Bierce & Smith-Valle Co., Dayton, O.

FELLOE PLATES—
Avery Stamping Co., Cleveland, O.

FILES, MAKERS OF—
C. H. Besly & Co., Chicago, Ill.

FILTER PRESSES—
Stilwell-Bierce & Smith-Valle Co., Dayton, O.

FILTERS—
Wm. B. Scaife & Sons, Pittsburg, Pa.
Pittsburg Filter Mfg. Co., Pittsburg, Pa.

FIRE BRICK AND CLAY—
J. V. Rose, Sharon, Pa.
Union Mining Co., Mt. Savage, Md.
Clearfield Fire Brick Co., Clearfield, Pa.
Dover Fire Brick Co., Cleveland, O.
F. B. Stevens, Detroit, Mich.
Chicago Fire Brick Co., Chicago, Ill.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth O.
Webster Fire Brick Co., South Webster, O.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
F. B. Holmes & Co., Detroit, Mich.
W. H. Haws Fire Brick Co., Mt. Union, Pa.
Garden City Sand Co., Chicago, Ill.
A. F. Smith & Co., New Brighton, Pa.
Chas. Taylor's Sons Co. Cincinnati, O.
A. J. Hawes & Son, Johnstown, Pa.
Scioto Fire Brick Co., Sciotoville, O.
Crown Fire Clay Co., Akron, O.

FIRE PROOF COVERING—
C. H. Besly & Co., Chicago, Ill.

FOOT AND POWER LATHES—
U. Baird Machinery Co., Pittsburg, Pa.

FORGINGS—
Chicago Drop Forge & Foundry Co., Kensington, Ill.
Cleveland City Forge & Iron Co., Cleveland, O
Bethlehem Steel Co., South Bethlehem, Pa.
Wyman & Gordon, Worchester, Mass.
Danielson Machine & Tool Co., Cleveland, O.
Samuel Trethewey & Co., Pittsburg, Pa.
Jas H. Baker Mfg. Co., Pittsburg, Pa.
Frankford Steel & Forging Co., Philadelphia, Pa
Pilling & Crane, Philadelphia, Pa.
Vulcanus Forging Co., Cleveland, O.
E. D. Clapp Mfg. Co., Auburn, N. Y.

FOUNDRIES—
Wm. Tod & Co., Youngstown, O.
Seaman, Sleeth Co., Pittsburg, Pa.
Hooven, Owens & Rentschler Co., Hamilton, O
Link Belt Machinery Co., Chicago, Ill.
W. A. Jones Foundry Co., Chicago.
effrey Mfg. Co., Columbus, O.
Brass Founders' Supply Co., Newark, N. J.
The Aultman Co., Canton, O.
Schuylkill Iron & Steel Co., Philadelphia, Pa.
Wheeling Mold & Foundry Co., Wheeling, W. V.
Enterprise Mfg. Co., Columbiana, O.
E. R. Allen, Corning, N. Y.

FOUNDRY EQUIPMENT.
Tabor Mfg. Co., Elizabeth, N. J.
Brass Founders Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Northern Engineering Works, Detroit, Mich.
Cleveland Crane & Car Co., Cleveland, O.
Thos. Furlow & Son, Philadelphia, Pa.
Jos. F. Bissell, Agt Prentiss Tool & Supply Co. Pittsburg, Pa.

FOUNDRY FACINGS—
Cleveland Facing Mill Co., Cleveland, O.

FOUNDRY SUPPLIES—
Northern Engineering Works, Detroit, Mich.
Chas. Taylor's Sons Co., Cincinnati, O.
Clearfield Fire Brick Co., Clearfield, Pa.
Cleveland Crane & Car Co., Cleveland, O.
Thos. Furlow & Son, Philadelphia, Pa.
The Ohio Sand Co., Conneaut, O.
Union Mining Co., Mt. Savage, Md.
Dover Fire-Brick Co., Cleveland, O.
A. F. Smith & Co., New Brighton, Pa.
Tabor Mfg. Co., Elisabeth, N. J.
F. B. Stevens, Detroit, Mich.
W. H. Haws Fire Brick Co., Mt. Union, Pa.
Cleveland Facing Mill Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Chicago Fire Brick Co., Chicago, Ill.
Brass Founders' Supply Co., Newark, N. J.
Vulcan Mfg. Co., Pittsburg, Pa.
Scioto Star Fire Brick Works, Portsmouth, O.
Kentucky Fire Brick Works, Portsmouth, O.
Webster Fire Brick Co., South Webster, O
J. V. Rose, Sharon, Pa.
Oak Hill Fire Brick & Coal Co., Oak Hill, O.
F. B. Holmes & Co., Detroit, Mich.
A. J. Haws & Son, Johnstown, Pa.
Webster Foundry Sand Co., Philadelphia, Pa.
Scioto Fire Brick Co., Sciotoville, O.
Newport Sand Bank Co., Newport Ky.
Crown Fire Clay Co., Akron, O.

FRICTION METAL—
James B. Clow & Sons, Chicago, Ill.
Theo. Hierts & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
J. J. Ryan & Co., Chicago. Ill.

FURNACE LININGS—
Union Mining Co., Mt. Savage, Md.

FUEL OIL BURNERS—
Rockwell Engineering Co., New York City.

GALVANIZED IRON—
American Sheet Steel Co., New York City.
McCullough Iron Co., Wilmington, Del.

GALVANIZERS—
American Sheet Steel Co., New York City.

GALVANIZING POTS—
The Wm. B. Pollock Co., Youngstown, O.

GAS ENGINES—
Northern Engineering Works, Detroit, Mich
Columbus Machine Co., Columbus, O.
Atlas Machine Co., Pittsburg, Pa.

GAUGE COCKS—
James Bonar & Co., Pittsburg, Pa.

GEARING—
I. & E. Greenwald Co., Cincinnati, O.
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.
Fraser & Chalmers, Chicago, Ill.
Southwark Foundry & Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
Link Belt Machinery Co., Chicago, Ill.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

GEAR CUTTERS—
F. H. Bultman & Co., Cleveland, O.

GEAR CUTTING—
The R. D. Nuttall Co., Allegheny, Pa.
The Van Dorn & Dutton Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.

GEAR LUBRICANTS—
The Ironsides Company, Columbus, O.

GIRDER WORK—
Wm. B. Scaife & Sons, Pittsburg, Pa.

GRINDSTONES—
C. H. Besly & Co., Chicago, Ill.

GRAPHITE PAINT—
Jos Dixon Crucible Co., Jersey City, N. J.

GRATE BARS—
Geo. B. Sennett Co., Youngstown, Ohio.

HACK SAWS—
Cleveland Punch & Shear Wks. Co., Cleveland, O

HANGERS—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
I. & E. Greenwald Co., Cincinnati, O.
Link Belt Machinery Co. Chicago, Ill.

HARNESS SNAPS—
Covert Mfg. Co., West Troy, N. Y.

HEATERS AND PURIFIERS—
Harrison Safety Boiler Works Philadelphia.
James Bonar & Co., Pittsburg, Pa.
Wefugo Co., Cincinnati, O.
The United Boiler Co., Girard, O

HEAVY HARDWARE—
C. H Besly & Co., Chicago, Ill.

HOISTS—
The Aultman Co., Canton, O.
Lidgerwood Mfg. Co., New York City.

HOISTING ENGINES—
The Edward P. Allis Co., Milwaukee, Wis.
Lidgerwood Mfg. Co., New York City.
Exeter Machine Works, Pittston, Pa.
The Aultman Co., Canton, O.
Webster, Camp & Lane Machine Co., Akron, O.
Vulcan Iron Works, Wilkes-Barre, Pa.

HOISTING MACHINERY—
Exeter Machine Works, Pittston, Pa.
Link-Belt Machinery Co., Chicago, Ill.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
The Aultman Co., Canton, O.
The Brown Hoisting and Conveying Machine Co., Cleveland, O.
Webster, Camp & Lane Machine Co., Akron, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.

HOISTING ROPE (WIRE)—
American Steel & Wire Co., Chicago, Ill.

HORSE SHOES—
Phoenix Horse Shoe Co., Joliet, Ill
American Steel & Wire Co., Chicago, Ill.

INDUSTRIAL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

INGOT MOLDS—
Lorain Foundry Co., Lorain, O.

INJECTORS—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

INSURANCE COMPANIES—
Hartford Steam Boiler I. & I. Co., Hartford, Ct.

IRON BUILDINGS—
Illinois Steel Co., Chicago, Ill.
Riter-Conley Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.
American Bridge Co., New York City.

IRON, NAILS AND STEEL—
C. H. Besly & Co., Chicago, Ill.

IRON AND STEEL ROOFING—
Berger Mfg. Co., Canton, O.
Wm. B. Scaife & Sons, Pittsburg, Pa.
McCullough Iron Co., Wilmington, Del.

IRON ORE—
Lake Superior Consolidated Iron Mines New York City, N. Y.
Oglebay, Norton & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill.
M. A. Hanna & Co., Cleveland, O.
Drake Bartow & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.
J. Wesley Pullman, Philadelphia, Pa.
Tod, Stambaugh & Co., Cleveland, O.
Jerome Keeley & Co., Philadelphia, Pa.

IRON WORKING MACHINERY—
Atlas Machine Co., Pittsburg, Pa.

IRON WORKING TOOLS—
Avery Stamping Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
H. Bickford, Lakeport, N. H.
C. H. Besly & Co. Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Armstrong Bros. Tool Co., Chicago, Ill.
F. H. Bultman & Co., Cleveland, O.
The Armstrong Mfg. Co., Bridgeport, Conn.
Bickford Drill & Tool Co., Cincinnati, O.
Bertsch & Co., Cambridge City, Ind.
Thos. P. Conard, Philadelphia, Pa.
C. C. Wormer Machinery Co., Detroit, Mich.
Carlin Machinery & Supply Co., Allegheny, Pa.
Bethlehem F'dry & Mach. Co., S. Bethlehem, Pa.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co. Pittsburg, Pa.

LADLES—
Northern Engineering Works, Detroit, Mich.
The United Boiler Co., Girard, O.
Wm. B. Pollock Co., Youngstown, O.
Whiting Foundry Equipment Co., Harvey, Ill.

LAG SCREWS—
Vulcanus Forging Co., Cleveland, O.

LATHES—
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co.
Springfield Machine Tool Co., Springfield, O.
Joseph E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.

LATHE TOOLS—
Armstrong Bros. Tool Co., Chicago, Ill.

LINK BELTING—
The Jeffrey Mfg. Co., Columbus, O.
Link-Belt Machinery Co., Chicago, Ill.
Heyl & Patterson, Pittsburg, Pa.
The Aultman Co., Canton, O.

LOCOMOTIVES—
Hyde Bros. & Co., Pittsburg, Pa.

LUBRICANTS—
The Ironsides Co., Columbus, O.

MACHINE TOOLS—
H. Bickford, Lakeport, N. H.
C. H. Besly & Co., Chicago, Ill.
U. Baird Machinery Co., Pittsburg, Pa.
Bertsch & Co., Cambridge City, Ind.
Armstrong Bros. Tool Co., Chicago, Ill.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O.
F. H. Bultman & Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Carlin Machinery & Supply Co., Allegheny, Pa.
C. C. Wormer Machinery Co., Detroit, Mich.
Bethlehem F'dry & Mach. Co., S. Bethlehem, Pa.
Pelton Engineering Co., Cleveland, O.
Atlas Machine Co., Pittsburg, Pa.
J. V. Burke, Chicago, Ill.
Joseph E. Bissell, Agt. Prentiss Tool & Supply Co., Pittsburg, Pa.

MACHINE SCREWS—
C. H. Besly & Co., Chicago, Ill.

MACHINERY AND TOOL STEEL—
C. H. Besly & Co., Chicago, Ill.
Bræburn Steel Co., Bræburn, Pa.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa
Byron H. White, Chicago, Ill.
Morris & Bailey Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.

MAGNESIA COVERING—
C. H. Besly & Co., Chicago, Ill.
James B Clow & Sons, Chicago, Ill.

MALLEABLE CASTINGS—
Acme Steel & Malleable Iron Works, Buffalo, N. Y
Link Belt Machinery Co., Chicago. Ill.
Meadville Malleable Iron Co., Meadville, Pa.

MANILLA ROPE—
A. Leschen & Sons Rope Co., St. Louis, Mo.

MANILLA ROPE COATING—
The Ironsides Co., Columbus, O.

MANUFACTURING CHEMISTS—
Wefugo Co., Cincinnati, O.
Grasselli Chemical Co., Cleveland, O.

MECHANICAL MACHINERY—
Century Machine & Mfg. Co., Mansfield, O.

METAL BEARINGS—
Theo. Hierts & Son, St. Louis, Mo.
C. H. Besly & Co., Chicago, Ill.
Perfect Lubricating Metal Co., Cincinnati, O.
J. J. Ryan & Co., Chicago, Ill.

METAL CEILINGS—
Berger Manufacturing Co., Canton, O.

METAL WORK—
Avery Stamping Co., Cleveland, O.

MILL CASTINGS—
Schuykill Iron & Steel Co., Philadelphia, Pa.
A. Garrison Foundry Co., Pittsburg, Pa

MILLING MACHINES—
U. Baird Machinery Co., Pittsburg, Pa.
Danielson Machine & Tool Co., Cleveland, O.

MINING MACHINERY—
C. H. Besly & Co., Chicago, Ill.
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
Lidgerwood Mfg. Co., New York City.
Exeter Machine Works, Pittson, Pa.
Wm. Cramp & Sons, Philadelphia, Pa
The Bucyrus Co., South Milwaukee, Wis.
Marion Steam Shovel Co., Marion, O.
Webster, Camp & Lane Machine Co., Akron, O.
Fraser & Chalmers, Chicago, Ill.
Wm. B. Pollock Co., Youngstown, O.
Link Belt Machinery Co., Chicago, Ill.
Thew Automatic Shovel Co., Lorain, O.
A. Leschen & Sons Rope Co., St. Louis, Mo.
Carlin Machinery & Supply Co., Allegheny, Pa.
Vulcan Iron Works, Wilkes-Barre, Pa.

MINE PUMPS—
F. M. Prescott Steam Pump Co., Milwaukee, Wis.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

MOLDING MACHINES—
Tabor Mfg. Co., Elizabeth, N. J.
Thos. Furlow & Son, Philadelphia, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

MOLDING SAND—
Ohio Sand Co., Conneaut, O.
F. B. Stevens, Detroit, Mich.
Garden City Sand Co., Chicago, Ill.
Webster Foundry Sand Co., Philadelphia, Pa.
Newport Sand Bank Co., Newport, Ky

MULTIPLE DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co. Pittsburg, Pa.

NICKEL PLATING OUTFITS—
Northampton Emery Wheel Co., Chicago, Ill.

NUTS (Self-Locking)—
National Elastic Nut Co., Milwaukee, Wis.

NUTS AND BOLTS—
Upson Nut Co., Cleveland, O.
National Elastic Nut Co., Milwaukee, Wis.
Milton Manufacturing Co., Milton, Pa.

OILLESS BEARINGS—
C. H. Besly & Co., Chicago, Ill.

OIL BURNERS—
Rockwell Engineering Co., New York City.

OIL CUPS—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

OIL FILTERS—
James Bonar & Co., Pittsburg, Pa.

OIL PUMPS—
C. H. Besly & Co., Chicago, Ill.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
James Bonar & Co., Pittsburg, Pa.

OIL STORAGE TANKS—
Wm. B. Pollock Co., Youngstown, O.

OIL SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

OIL TANKS AND CARS—
Wm. B. Pollock Co., Youngstown, O.

ORE CARS—
The Pressed Steel Car Co. Pittsburg, Pa.

ORE CRUSHERS—
The Edward P. Allis Co., Milwaukee, Wis.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers Chicago, Ill.

ORE HANDLING MACHINERY—
A. Leschen & Sons Rope Co., St. Louis, Mo.

ORE SCREENS—
Rob't Aitchison Per. Metal Co., Chicago, Ill.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.
Hendrick Mfg. Co., Carbondale, Pa.
Western Machinery & Supply Co., Chicago, Ill.

ORE TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa

PACKING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James B. Clow & Sons, Chicago, Ill.
A. Leschen & Sons Rope Co., St. Louis, Mo.

PAINT—
Iron Clad Paint Co., Cleveland, O.
Jos. Dixon Crucible Co., Jersey City, N. J.
The Ironsides Co., Columbus, O.

PATENT ATTORNEYS—
Wm. N. Cromwell, Washington, D. C.

PATTERN WORKS—
Gobeille Pattern Co., Cleveland, O.
Forsythe Pattern Works, Youngstown, O.
C. Birnbaum, Cleveland, O.
Buffalo Gear and Pattern Works, Buffalo, N. Y.
Balkwill Pattern Works, Cleveland, O.
Mt. Vernon Pattern & Model Works, Mt. Vernon, O.

PERFORATED METALS—
Aitchison Perforated Metal Co., Chicago, Ill.
Fraser & Chalmers, Chicago, Ill.
Hendrick Mfg. Co., Carbondale, Pa.
Western Machinery & Supply Co., Chicago, Ill.

PIG IRON—
Cabeen Co., Philadelphia, Pa.
Rogers, Brown & Co., Cincinnati, O.
Reed F. Blair & Co., Pittsburg, Pa.
Clinton Iron & Steel Co., Pittsburg.
Bourne-Fuller Co. Cleveland, O.
M. A. Hanna & Co., Cleveland, O.
Pickands, Brown & Co., Chicago, Ill
F. B. Stevens, Detroit, Mich.
McKeefrey & Co., Leetonia, O.
Superior Charcoal Iron Co., Grand Rapids, Mich
Spearman Iron Co., Sharpsville, Pa.
Hickman, Williams & Co., Chicago, Ill,
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Chicago, Ill.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill,
J. H. Hillman & Son, Pittsburg, Pa.
C. R. Baird & Co., Philadelphia, Pa.
Pilling & Crane, Philadelphia, Pa.
Sloss Sheffield Steel & Iron Co., Birmingham, Ala
Cherry Valley Iron Co., Pittsburg, Pa.
Jerome Keeley & Co., Philadelphia, Pa.
American Steel & Wire Co., Chicago, Ill.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

PIPE (CAST IRON)—
James B. Clow & Sons, Chicago, Ill.
Massillon Iron & Steel Co., Chicago, Ill.

PIPE (RIVETED STEEL)—
Wm. B. Scaife & Sons, Pittsburg, Pa
Wm. B. Pollock Co., Youngstown, O.

PIPE COVERING—
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.

PIPE CUTTING AND THREADING MACHINES—
The Armstrong Mfg. Co., Bridgeport, Conn.

PISTON RODS—
Bethlehem Steel Co., So. Bethlehem, Pa.

PLANERS—
U. Baird Machinery Co., Pittsburg, Pa.
Bickford Drill & Tool Co., Cincinnati, O.
Danielson Machine & Tool Co., Cleveland, O
Atlas Machine Co., Pittsburg, Pa.
Springfield Machine Tool Co., Sprinfield, O.

PLANER TOOLS—
Armstrong Bros. Tool Co., Chicago, Ill.

PLANISHED IRON—
American Sheet Steel Co., New York City.

PLATES—
Enterprise Boiler Co., Youngstown, O.
Republic Iron & Steel Co., Chcago, Ill.
Illinois Steel Co., Chicago, Ill.

PLUMBERS' AND GAS FITTERS' SUPPLIES—
C. H. Besly & Co., Chicago, Ill.
James B. Clow & Sons, Chicago, Ill.

PNEUMATIC APPLIANCES—
Clayton Air Compressor Works, New York.
W. J. Schaefer & Co., New York City.

PORTABLE FORGE—
C. H. Besly & Co., Chicago, Ill.
Vulcan Mfg. Co., Pittsburg, Pa.

POWER PRESSES—
Avery Stamping Co., Cleveland, O.
Bertsch & Co., Cambridge City, Ind.
Cleveland Punch & Shear Wks. Co., Cleveland, C.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Bethlehem F'dry & Mach. Co. S. Bethlehem, Pa.

POWER TRANSMISSON MACHINERY—
Jeffrey Mfg. Co., Columbus, O.
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
I. & E. Greenwald Co., Cincinnati, O.
Link Belt Machinery Co., Chicago, Ill,
A. Leschen & Sons Rope Co., St. Louis, Mc.
Stillwell-Bierce & Smith-Vaile Co., Dayton, O.

PRESSES—
Bertsch & Co., Cambridge City, Ind.
C. H. Besly & Co., Chicago, Ill.
E. Konigslow & Bro. Cleveland, O.
Danielson Machine & Tool Co., Cleveland, O.
Avery Stamping Co., Cleveland, O.
Bethlehem F'dry & Mach. Co., S. Bethlehem, Pa.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Atlas Machine Co., Pittsburg, Pa.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co. Pittsburg, Pa.

PRESSURE GAUGES—
The Bristol Co., Waterbury, Conn.
James Bonar & Co., Pittsburg, Pa.

PULLEYS—
W. A. Jones Foundry Co., Chicago, Ill
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
I. & E. Greenwald Co., Cincinnati, O.
Link Belt Machinery Co., Chicago, Ill.
A. Leschen & Sons Rope Co., St. Louis, Mo.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.

PUMPS (STEAM)—
The Edward P. Allis Co., Milwaukee, Wis
Blakeslee Mfg. Co., Du Quoin, Ill.
James Bonar & Co., Pittsburg, Pa.
Fred M. Prescott Steam Pump Co., Milwaukee Wis.
Hall Steam Pump Co., Pittsburg, Pa.
Southwark Foundry & Machine Co., Philadelphia, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
The Deming Co., Salem, O.

PUNCHES—
E. Konigslow & Bro. Cleveland, O.

PYROMETERS—
Edward Brown, Philadelphia, Pa.
Vulcan Mfg. Co., Pittsburg, Pa.

RADIAL DRILLS—
Bickford Drill and Tool Co., Cincinnati, O.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co. Pittsburg, Pa.

RAILS—
Hyde Bros. & Co., Pittsburg, Pa.
American Steel Hoop Co., New York City.

RAILWAY SUPPLIES—
Cleveland City Forge & Iron Co., Cleveland, O.
Garden City Sand Co., Chicago, Ill.
Hyde Bros & Co., Pittsburg, Pa.

RELAYING RAILS—
Hyde Bros. & Co., Pittsburg, Pa.

RIVETS—
Champion Rivet Co., Cleveland, O.
Vulcanus Forging Co., Cleveland, O.

RIVETED STEEL PIPE—
The Wm. B. Pollock Co. Youngstown, O.

ROCK DRILLS—
Rand Drill Co., Chicago, Ill.
The Ingersoll-Sergeant Drill Co., New York.

ROLL FORGINGS—
Samuel Trethewey & Co., Pittsburg, Pa.
Frankford Steel & Forging Co., Philadelphia, Pa.

ROLLING MILL MACHINERY—
The United Boiler Co., Girard, O.
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
The Lloyd Booth Co., Youngstown, O.
West Penn Foundry & Machine Co., Avonmore, Pa.
Frank-Kneeland Machine Co., Pittsburg, Pa.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O
A. Garrison Foundry Co., Pittsburg, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

ROOFS—
Riter-Conley Mfg. Co., Pittsburg, Pa.
Wm. B. Scaife & Sons, Pittsburg, Pa.
McCullough Iron Co., Wilmington, Del.
American Bridge Co., New York City.

ROPE—
A. Leschen & Sons Rope Co., St. Louis, Mo.

ROPE AND CORDAGE—
Waterbury Rope Co., New York City.
Link Belt Machinery Co., Chicago, Ill.

SAFETY WATER COLUMNS—
James Bonar & Co., Pittsburg, Pa.

SAWS—
Peter Gerlach & Co., Cleveland, O.

SCRAP IRON—
Hyde Bros. & Co., Pittsburg, Pa.
Illinois Steel Co., Chicago, Ill.

SCREENS FOR COAL, ORE, ETC.—
Robt. Aitchison Perforated Metal Co., Chicago.
Hendrick Mfg. Co., Carbondale, Pa.
Jeffrey Mfg. Co., Columbus, O.
The Aultman Co., Canton, O.
Fraser & Chalmers, Chicago, Ill.
Western Machinery & Supply Co., Chicago, Ill.

SCREWS—
C. H. Besly & Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
Chicago Screw Co., Chicago, Ill

SCREW MACHINES—
American Tool Works Co., Cincinnati, O.

SECOND-HAND MACHINERY—
Hyde Bros. & Co., Pittsburg, Pa.
The Atlas Machine Co., Pittsburg, Pa.
The W. J. Carlin Co., Pittsburg, Pa.
C. C. Wormer Machinery Co., Detroit, Mich.
Carlin Machinery & Supply Co., Allegheny, Pa.
Pelton Engineering Co., Cleveland, O.
J. V. Burke, Chicago, Ill.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co. Pittsburg, Pa.

SEPARATORS—
Harrison Safety Boiler Works, Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.

SHAFTING—
E. A. Delano, Chicago, Ill.
Dodge Mfg. Co., Mishawaka, Ind.
Pittsimmons & Co., Cleveland, O.
The Aultman Co., Canton, O.
Atlantic Tube Co., Pittsburg, Pa.
Jeffrey Mfg. Co., Columbus, O.
I. & E. Greenwald Co., Cincinnati, O.
Bethlehem Steel Co., South Bethlehem, Pa.
American Steel & Wire Co., Chicago, Ill.
Link Belt Machinery Co., Chicago, Ill.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O.
Atlas Machine Co., Pittsburg, Pa.

SHEARING AND PUNCHING MACHINERY—
Bertsch & Co., Cambridge City, Ind.
Danielson Machine & Tool Co., Cleveland, O.
Cleveland Punch & Shear Wks. Co., Cleveland, O.
Bethlehem F'dry & Mach. Co., S. Bethlehem, Pa.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co. Pittsburg, Pa.

SHAPERS—
Atlas Machine Co., Pittsburg, Pa.
Springfield Machine Tool Co., Springfield, O.

SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SHEET IRON AND STEEL—
Republic Iron & Steel Co., Chicago, Ill.
American Sheet Steel Co., New York City.
McCullough Iron Co., Wilmington, Del.
American Steel & Wire Co., Chicago, Ill.

SHIP YARDS—
Wm. Cramp & Sons, Philadelphia, Pa.

SOLID STEEL SHEAR KNIVES—
Samuel Trethewey & Co., Pittsburg, Pa.

SPECIAL MACHINERY—
Cleveland Punch & Shear Wks. Co., Cleveland, O.
James Bonar & Co., Pittsburg, Pa.
Avery Stamping Co., Cleveland, O.
The Aultman Co., Canton, O.
Jeffrey Mfg. Co., Columbus, O.
E. Konigslow & Bro. Cleveland, O.
Wheeling Mold & Foundry Co., Wheeling, W. Va
Danielson Machine & Tool Co., Cleveland, O
Enterprise Mfg. Co., Columbiana, O.
Century Machine & Mfg. Co., Mansfield, O.
Jos. E. Bissell, Agt. Prentiss Tool & Supply Co. Pittsburg, Pa.

STACKS—
Wm. B. Scaife & Sons, Pittsburg, Pa.

STAND PIPES—
The Wm. B. Pollock Co., Youngstown, O.
The United Boiler Co., Girard, O.

STEAM BOILER INSPECTORS—
Hartford Steam Boiler Inspection & Insurance Co., Hartford, Conn.

STEAM PIPE AND BOILER COVERING—
C. H. Besly & Co., Chicago Ill.

STEAM PACKING—
James B. Clow & Sons, Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.

STEAM PUMPS—
Hall Steam Pump Co., Pittsburg, Pa.
Blakeslee Mfg. Co., Du Quoin, Ill.
Fred. M. Prescott Steam Pump Co., Milwaukee, Wis.
Edw. P. Allis Co., Milwaukee, Wis.
Southwark Foundry and Machine Co., Philadelphia, Pa.
James Bonar & Co., Pittsburg, Pa.
Stilwell-Bierce & Smith-Vaile Co., Dayton, O
The Deming Co., Salem, O.

STEAM SEPARATORS—
James Bonar & Co., Pittsburg, Pa.
Harrison Safety Boiler Works, Philadelphia, Pa.
Wright Manufacturing Co., Cleveland, O.

STEAM SHOVELS AND DREDGES—
Marion Steam Shovel Co., Marion, O.
The Bucyrus Co., South Milwaukee, Wis.
The Thew Automatic Shovel Co., Lorain, O.

STEAM SPECIALTIES—
C. H. Besly & Co., Chicago, Ill.
James Bonar & Co., Pittsburg, Pa.

STEEL—
Otis Steel Co., Cleveland, O.
Cabeen Co., Philadelphia, Pa.
Champion Iron & Steel Co., Muskegon, Mich
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
The Morris & Bailey Steel Co., Pittsburg, Pa.
Byron H. White, Chicago, Ill.
Monongahela Iron & Steel Co., Pittsburg Pa.
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.
C. R. Baird & Co., Philadelphia, Pa.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

STEEL BANDS—
American Steel Hoop Co., Pittsburg, Pa.
American Steel & Wire Co Chicago, Ill.

STEEL BLOOMS AND BILLETS—
American Steel & Wire Co., Chicago, Ill.
Cabeen Co., Philadelphia, Pa.
Champion Iron & Steel Co., Muskegon, Mich
National Steel Co., Chicago. Ill.
Bethlehem Steel Co., South Bethlehem, Pa.
The Lorain Steel Co., Lorain, O.
American Steel Hoop Co., Pittsburg, Pa.
C. R. Baird & Co., Philadelphia, Pa.
Jerome Keeley & Co., Philadelphia, Pa.
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala.

STEEL CARS—
The Pressed Steel Car Co., Pittsburg, Pa.

STEEL CASTINGS—
Otis Steel Co., Cleveland, O.
Bethlehem Steel Co., South Bethlehem, Pa.
Acme Steel & Malleable Iron Works, Buffalo N. Y.

STEEL CEILINGS—
Berger Manufacturing Co., Canton, O.

STEEL FRAME MILL BUILDINGS—
Wm. B. Scaife & Sons, Pittsburg, Pa.
American Bridge Co., New York City.

STEEL HOOPS—
American Steel Hoop Co., Pittsburg, Pa

STEEL PLANTS—
The Wm. B. Pollock Co., Youngstown, O
The Riter-Conley Co., Pittsburg, Pa.

STEEL SHEETS—
Republic Iron & Steel Co., Chicago, Ill.
American Sheet Steel Co., New York City.
McCullough Iron Co., Wilmington, Del.
American Steel & Wire Co., Chicago, Ill.

STOKERS –
Century Machine & Mfg. Co., Mansfield, O.

TANKS—
Enterprise BoilerCo., Youngstown, O.
Meehan Boiler&Construction Co., Lowellville O
Wm. B. Scaife & Sons, Pittsburg, Pa.
The Wm. B. Pollock Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburg, Pa.
The Aultman Co., Canton, O.
The United Boiler Co., Girard, O.

TANK CARS—
The Wm. B. Pollock Co., Youngstown, O

TESTING MACHINERY—
Keystone Driller Co., Beaver Falls, Pa.

TIN AND TERNE PLATES—
American Tin Plate Company, New York City.
Champion Iron & Steel Co., Muskegon, Mich.

TIN PLATE MACHINERY—
Totten & Hogg Iron and Steel Foundry Co., Pittsburg, Pa.
West Penn Foundry&Machine Co.,Avonmore,Pa
Lloyd Booth Co., Youngstown, O.

TOOL HOLDERS—
Armstrong Bros. Tool Co., Chicago, Ill.

TOOL STEEL—
C. H. Besly & Co., Chicago, Ill.
Crescent Steel Co., Pittsburg, Pa.
La Belle Steel Co., Pittsburg, Pa.
Monongahela Iron & Steel Co., Pittsburg, Pa.
American Steel & Wire Co., Chicago, Ill.

TRAMWAYS—
A. Leschen & Sons Rope Co., St. Louis, Mo.

TRANSMISSION MACHINERY—
Link-Belt Machinery Co., Chicago, Ill
W. A. Jones Foundry & Machine Co., Chicago.
Jeffrey Mfg. Co., Columbus, O.
Dodge Mfg. Co., Mishawaka, Ind.
The Aultman Co., Canton, O.
Brown Hoisting and Conveying Machine Co., Cleveland, Ohio.

TRANSMISSION ROPE (WIRE)—
American Steel & Wire Co., Chicago, Ill.

TROLLEY TRACKS—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

TROLLEY WIRES—
American Steel & Wire Co., Chicago, Ill.

TRUCKS—
Northern Engineering Works, Detroit, Mich.

TUBES—
National Tube Co., Pittsburg, Pa.
S. Fix' Sons, Cleveland, O.

TUBE WELDING—
S. Fix Sons, Cleveland, O.

TUMBLERS—
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

TURBINE WATER WHEELS—
Stilwell-Bierce & Smith Vaile Co., Dayton, O.

TURNBUCKLES—
Republic Iron & Steel Co., Chicago, Ill.
Cleveland City Forge & Iron Co., Cleveland, O

TWIST DRILLS—
C. H. Besly & Co., Chicago. Ill.

TWIST DRILL CASES—
Vulcan Mfg. Co., Pittsburg, Pa.

VALVES—
James B. Clow & Sons, Chicago, Ill.
C. H. Besly & Co., Chicago, Ill.
Jenkins Bros., New York City.
James Bonar & Co., Pittsburg, Pa.

WASHERS—
Avery Stamping Co., Cleveland, O.
Milton Manufacturing Co., Milton, Pa.

WATER PIPE—
Massillon Iron & Steel Co., Chicago, Ill.

WATER SOFTENING PLANTS—
Wefugo Co., Cincinnati, O.
Pittsburg Filter Mfg. Co., Pittsburg, Pa.

WIRE—
American Steel & Wire Co., Chicago. Ill.
Summit Wire Co., Cuyahoga Falls, O.

WIRE COATING—
The Ironsides Company, Columbus, O.

WIRE FENCING—
American Steel & Wire Co., Chicago, Ill.

WIRE FILLER—
The Ironsides Company, Columbus, O.

WIRE MACHINERY—
S. W. Goodyear, Waterbury, Conn.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O

WIRE NAILS—
American Steel & Wire Co., Chicago, Ill.

WIRE ROPE—
Waterbury Rope Co., New York City.
A. Leschen & Sons Rope Co., St. Louis, Mo.
American Steel & Wire Co., Chicago, Ill.

WIRE ROPE COATING—
The Ironsides Company, Columbus, O.

WIRE ROPE FILLING—
The Ironsides Company, Columbus, O.

WOOD PULLEYS—
Dodge Mfg. Co., Mishawaka, Ind.

WROUGHT PIPE—
National Tube Co., Pittsburg, Pa.

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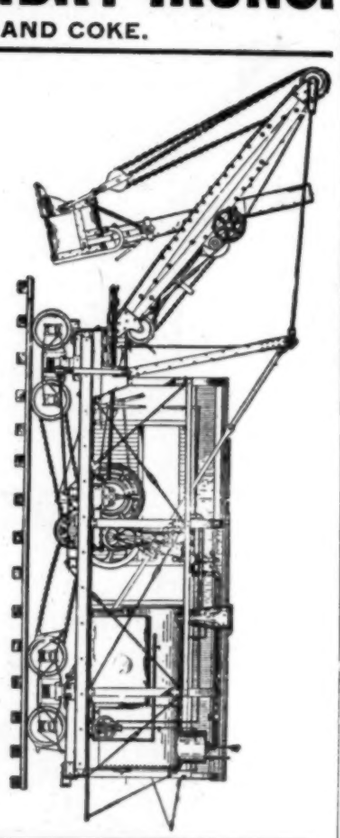

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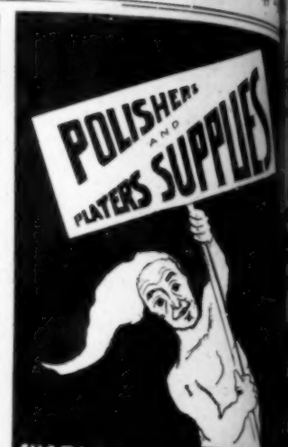

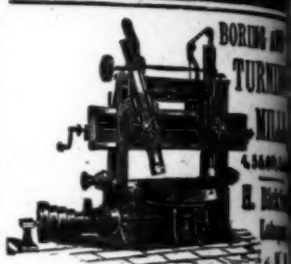

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